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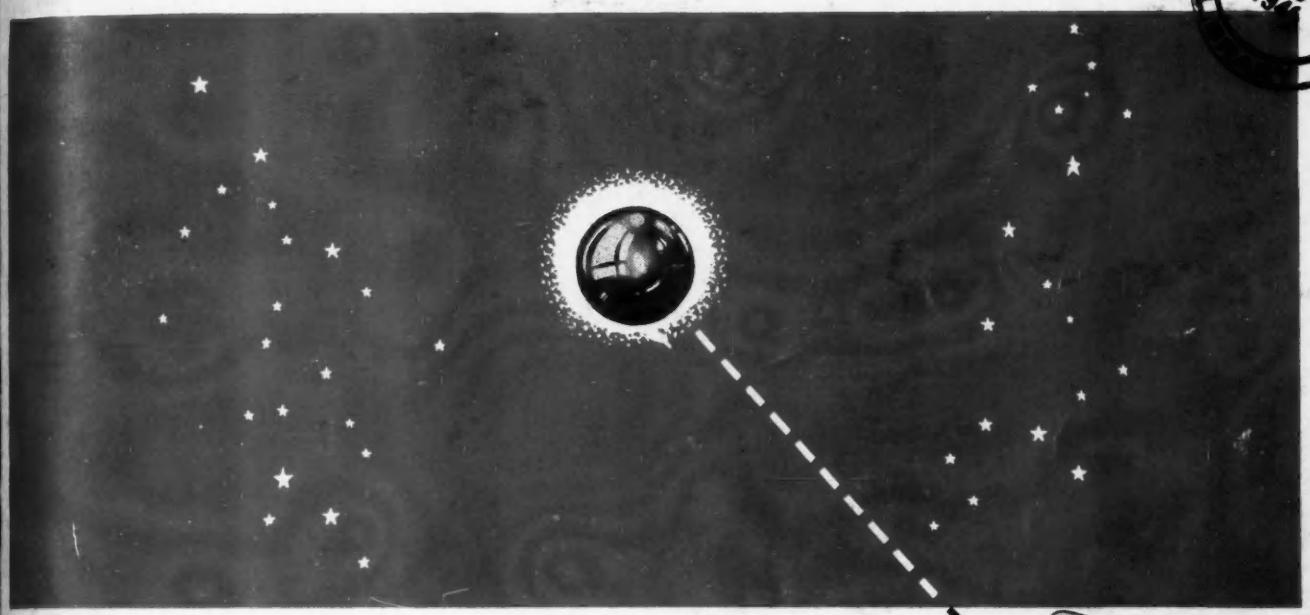

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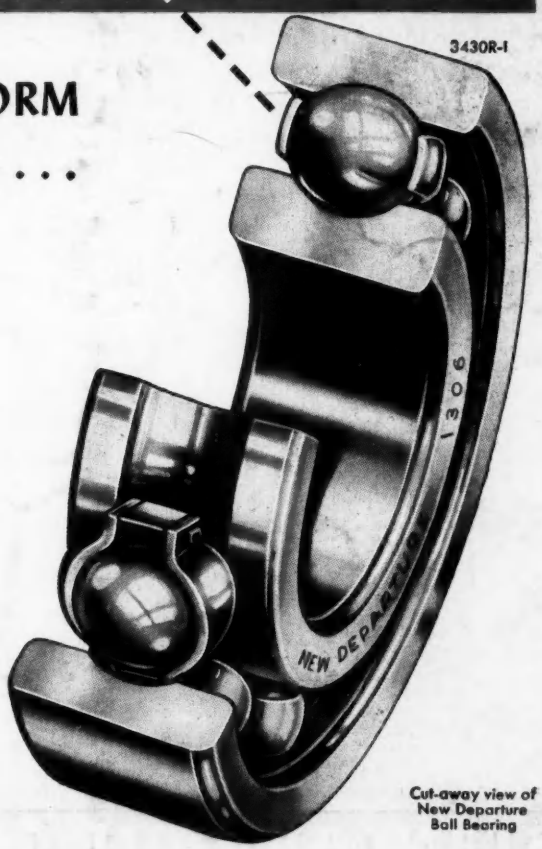

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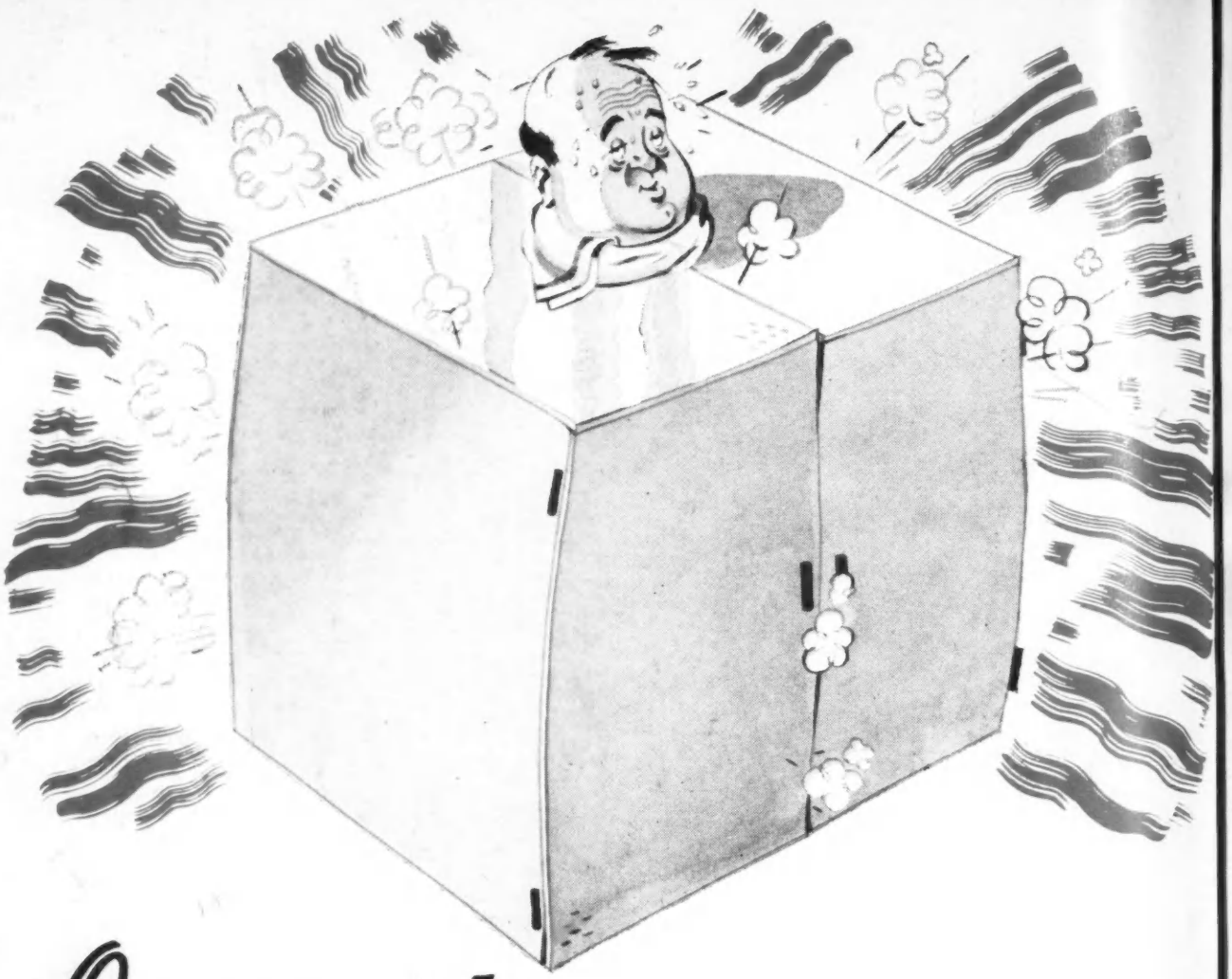

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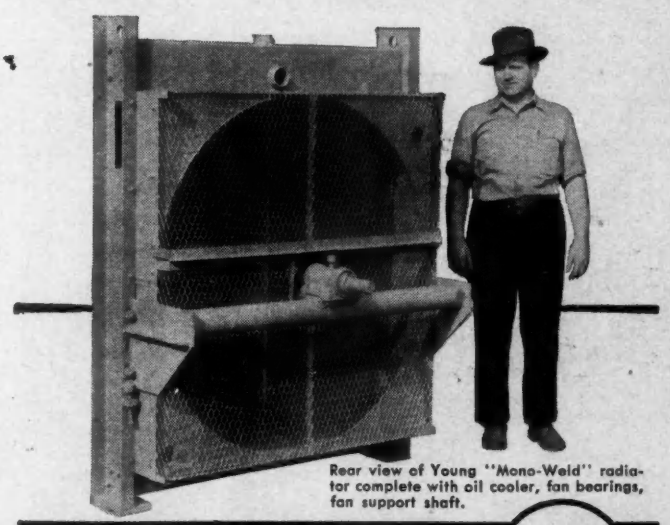

Rear view of Young "Mono-Weld" radiator complete with oil cooler, fan bearings, fan support shaft.

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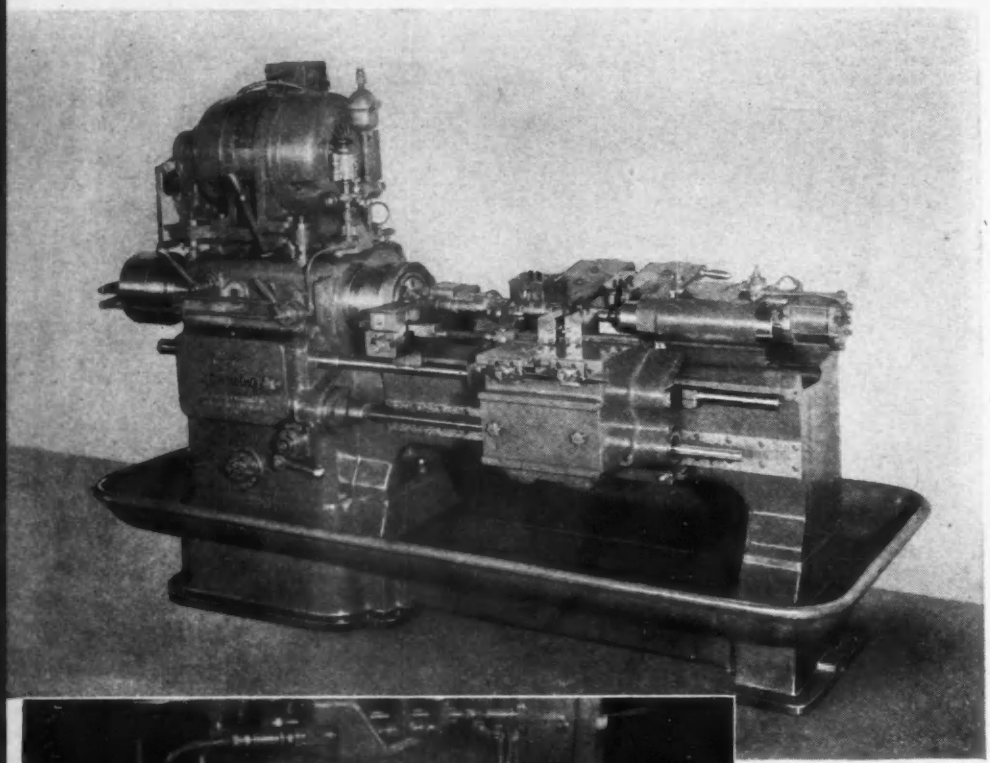

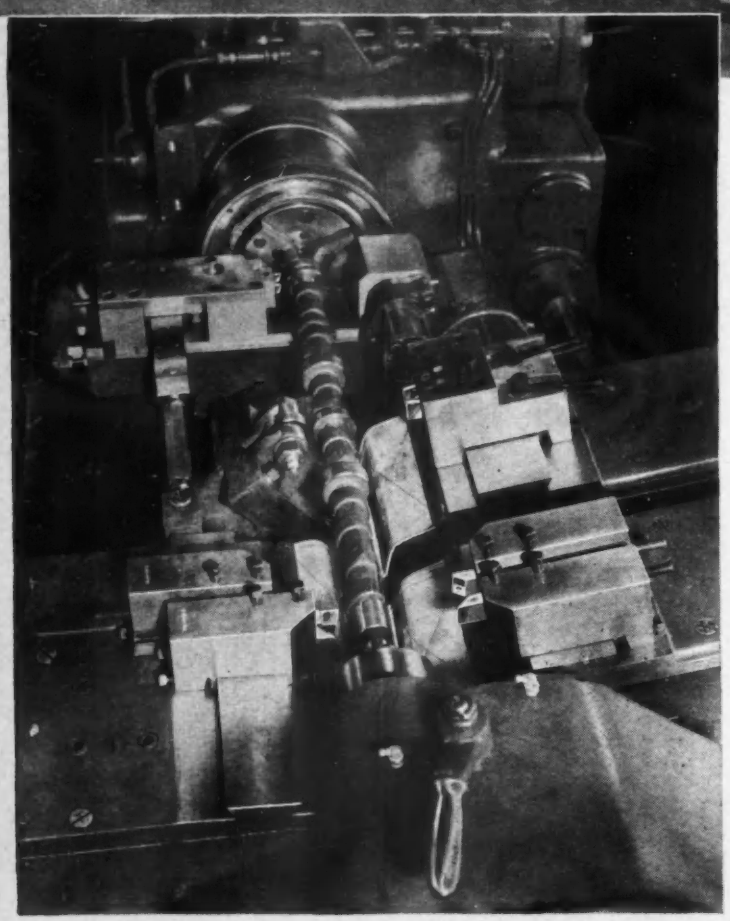

Lo-swing

AUTOMATIC LATH

incorporates unique feature

for cam-shaft job and

Reduces the Number
Operations Required

Problem: To perform the follow operations on a 6-cylinder cam-sh Cut double eccentric oil groove head bearing; rough and finish t small bearing; chamfer small b ing; face and chamfer oil pump d gear.

Solution: A 5x34" model "LR" swing Lathe was selected for this j It was equipped with a standard slide carriage, 2 back squaring attachments, front ste rest, a double eccentric grooving attachment and an au matic 2-speed headstock. This 2-speed headstock and automatic control are one of the unique features of tooling for this particular job. Since cemented carb tools were used, high speeds were essential for finish tu ing and squaring operations, yet were impractical for double eccentric grooving operation. The lathe au matically shifts from high speed upon completion turning and squaring operations, and goes into low sp for the double eccentric grooving operation.

The cam roller on the double eccentric grooving att ment is automatically withdrawn from the cam path d ing the high speed portion of the cycle.

Another interesting feature of this lathe is the 2-s carriage which accomplishes both roughing and finish cuts on the small bearing. The roughing tool on front slide relieves from the work before the tool on second slide moves in for the finish cut.

Consult our Engineering Department for time-sav equipment.

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LATHE NEWS from SENECA FALLS

AUTOMOTIVE and AVIATION INDUSTRIES

Published on the first and 15th of the month

Volume 95, No. 9
November 1, 1946

Power Without Purpose

By C. R. Cox
Pres. Carnegie-Illinois Steel Corp.

THE fact seems to be that reconversion and recovery, despite the inherent difficulties, have not done nearly as well as many hoped they would, and as past precedents would have justified. It was only nine months after Armistice Day, 1918, until industrial production had completed reconversion and climbed back to levels above those of Armistice Day. Today, more than a year after the war's end, industrial production is still far below that prevailing on V-J Day, and recently has been less than two-thirds of our peak war-time production.

We have been seeking, as a nation, to carry out our peace-time purposes under war-time principles. But the principles and purposes do not fit. This is fundamental. In war-time there is one paramount purpose. It is to win the war. Other purposes do not count much. To accomplish a single designated purpose, a military type of centralized dictatorial power may be desirable and efficient. So we set up a form of dictatorship authority to fight the war. That type of authority can be exercised effectively *to one given purpose.* The single purpose automatically provides a yardstick of judgment to determine who shall do this, and who shall be compelled to do that—even to the loss of his life.

In war-time it is easy to decide that steel should be used to build battleships instead of pleasure yachts. It is easy to decide that food and fuel shall be rationed, or anything else for that matter which is needed at the battle front. It is the *single* purpose, universally accepted, and it is that single purpose alone, which creates the need for and supplies the yardstick of judgment to guide a dictatorship that can deny all other conflicting purposes in directing under compulsion the activities of each individual.

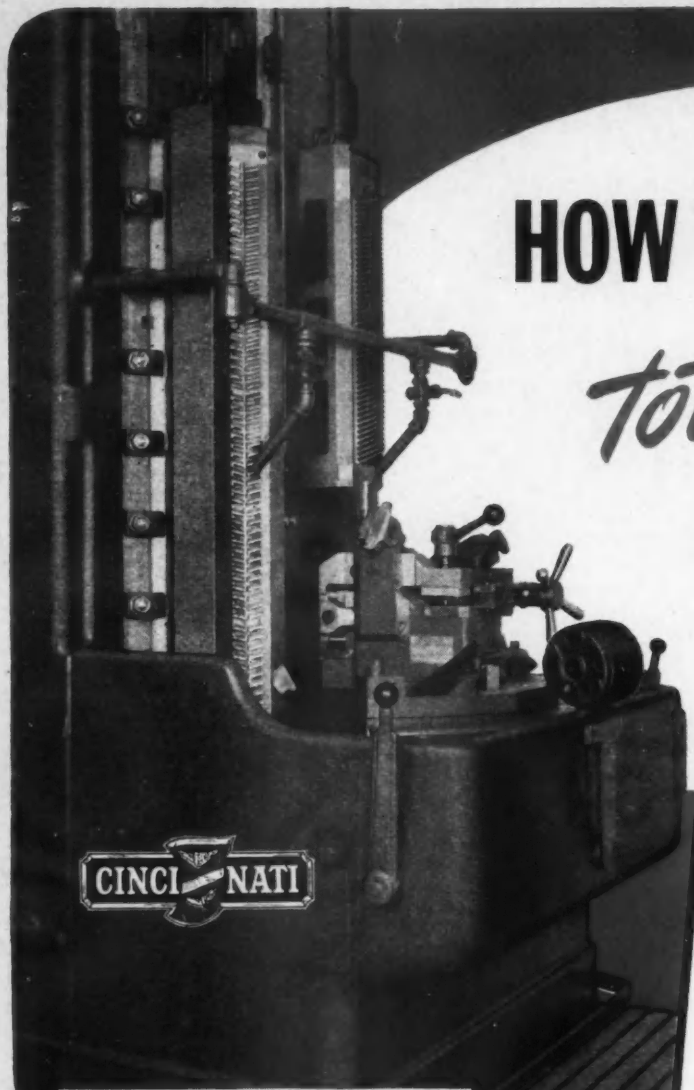
But what is the "one given purpose" of peace-time America? Is it "full employment"? If so, then employment in producing what, where, when, in what amount, at what price or wage, and for whose benefit? Can anyone name any *single* purpose that even remotely approaches in over-riding stature the war-time purpose? Some people want automobiles, while others want houses. Some want travel or education, or nylon hose, or gold watches, or books, or fine food, while others wish to be doctors, or lawyers, or engineers, or businessmen, or teachers, or even economists. It seems that too many want to be bureaucrats! Some desire to be in business for themselves, while others prefer that businessmen take the risks and hire them as employes. Some like to save and invest, while others prefer to expend their income as they go along. A moment's contemplation will prove to each person that there is not and never can be any "one given purpose" that transcends all others in a peace-time America that is constitutionally dedicated to securing justice, tranquillity and the blessings of liberty for each and every one of its individual citizens. Liberty means doing what *you* want to do, not what somebody else wants you to do, as long as the doing of it does not involve hurting or coercing others.

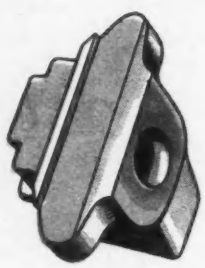
(*Turn to page* 70, *please*)

HOW TO BROACH

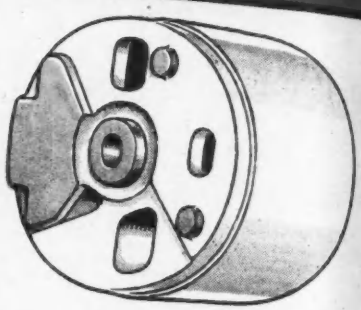
totally unlike parts

on one Duplex Machine



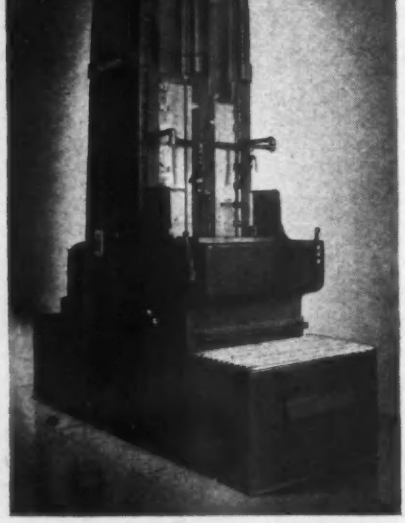


Part name—Compressor Cylinder
Material—Cast Iron
Operation—Broach Tongue and Bottom
Stock removal—1/16"-3/32"
Production—144 per hour



Part name—Compressor Motor Housing
Material—Cast Iron
Operation—Broach Hub, Pad, and Two Bosses
Stock removal—3/16"-1/4"
Production—144 per hour

Broached surfaces shown in color.



CINCINNATI No. 10-54 Duplex Vertical Hydro-Broach. Engineering specifications on the 3-, 5-, and 10-ton sizes may be obtained by writing for catalog M-1387-1.

● It's easy to see the advantages of broaching when the parts are produced continuously or in exceptionally large quantities. But, it's not so evident when the parts are totally unlike and produced in small quantities or at a comparatively slow rate of production. The equipment shown here illustrates how this can be accomplished at a low cost per piece. ¶The equipment comprises only one *machine*—a CINCINNATI No. 5-54 Vertical Duplex Hydro-Broach—tooled up by Cincinnati Application Engineers to *broach three parts*, one of which is *totally unlike* the other two. Two fixtures and two broach holder assemblies are supplied for the left-hand side to broach two similar cylinders, while the right-hand side is tooled up to broach the housings. In this manner, *one man, on one machine*, broaches housings alone, either one of two cylinders alone, or housings and cylinders together. ¶Perhaps many parts in your own shop, even though they are totally unlike, could be machined more economically by the broaching method. Our engineers would like to talk broaching with you. Send blue prints of the parts with complete production and cost requirements.

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Stubborn Facts and Foolish Fancies about Industry's Profits

by Andrew Court
Labor Economist
General Motors Corporation

ONE of the serious problems that continually face business and which has not been handled satisfactorily is the great misunderstanding of the simple facts of economic relations which characterize business operations.

In spite of the hundreds of pie charts which have been published showing the division of corporate business sales dollars, recent surveys show that factory workers and members of the public at large believe that for every dollar of factory payroll, executive salaries, and dividends to stockholders total one dollar, or in many cases more. Few people have any idea of the narrow margin of profit on which business typically operates.

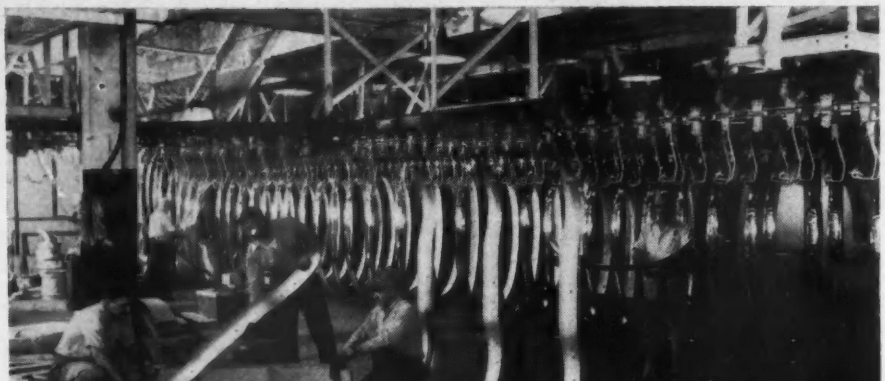
A bizarre illustration of some of the types of misunderstanding is provided by a review of the letters of generalized social complaint received by General Motors. For example, some critics commented to the effect that: "We note in 1919, 80,000 workers supported only 20,000 stockholders, but now 300,000 workers are supporting 400,000 stockholders, according to your Annual Report, and we don't believe that every poor worker should have to support a stockholder and a third."

Another not untypical comment is: "I notice that your gross was about 4 billion dollars and your wages about 1 billion. The union wanted a 30 per cent increase and it seems to me that you folks could have given them 300 million out of your 4 billion, or at least a good part of that amount, and still have had 3 billion 700 million left, which I should think would have been enough for the stockholders and vice presidents during this period of general strain. We realize, of course, that the union was

(*Turn to page 27, please*)

ACTUAL PROFIT AND LOSS RECORD
FOR ALL U.S. MANUFACTURING INDUSTRY
6.3% PROFIT IN 1929
2.3% IN 1930
1.2% IN 1931
4.6% LOSS IN 1932
1.7% IN 1933
2.6% IN 1934
3.8% IN 1935
5.2% IN 1936
4.7% IN 1937
2.3% IN 1938
5.2% IN 1939
5.8% IN 1940
6.2% IN 1941
4.4% IN 1942
3.9% IN 1943
3.5% IN 1944
3.3% IN 1945
2.7% IN 1946 (est.)
NOTE: Profits after taxes are stated as a per cent of sales in all U. S. manufacturing industry. Data are from U. S. Department of Commerce.
PUBLIC THINKS PROFITS SHOULD BE
10.0%
PUBLIC THINKS PROFITS HAVE BEEN
18% IN PEACETIME

Average profits have never been as high as the public thinks they should be. Here are shown actual profits of the U. S. manufacturing industry based on dollar sales.



Chevrolet bumper bars travel on the monorail conveyor from the chromium plating unit to the spray booth in the background, then overhead to the baking oven. On the return trip the bars are delivered to the shipping station which may be seen in the foreground.

Chevrolet's New S

By Joseph Geschelin

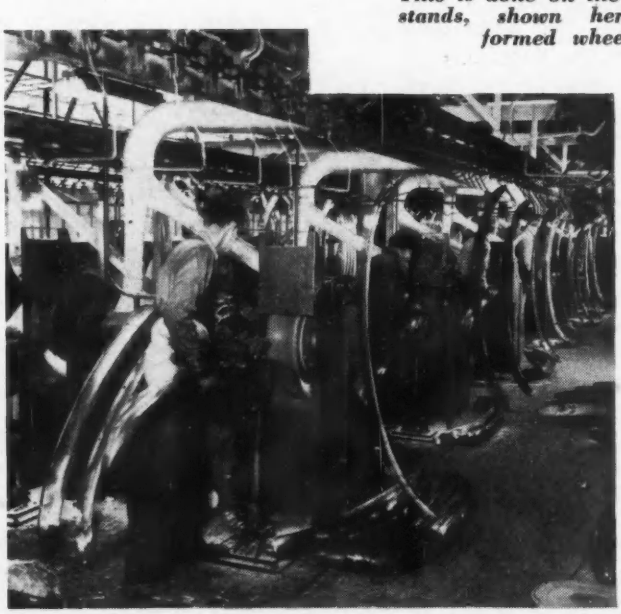
SINCE decorative chromium plate plays a leading role in the eye appeal of motor cars, it is important to recognize that durability as well as quality are dependent upon advanced plating techniques and, in particular, on the deposition of a "heavy" nickel coating. With this in mind the Chevrolet Forge & Bumper Division, General Motors Corp., at Detroit has adopted new practices designed to triple the minimum thickness of the plating on bumpers, as compared with the previous specification. This, in turn, lead to the installation of a new electro-plating department which was recently placed in operation.

This set-up produces a nickel coating of 0.0015 in., resulting from a cycle of 1½ hour duration in the nickel plating unit. Since time is the chief criterion in electro-deposition, the chemical laboratory has conducted considerable research to establish the most economical balance of pH of the nickel solutions, control of current density, control of temperature, etc., in the interest of maintaining specification quality with a minimum time cycle for the entire operation.

Bumper operations begin in the forge shop with the blanking and forming of the bar. Here will be found two Bliss presses, one for blanking from strip, the other for forming. As blanks are produced on the first press they are fed into a continuous cycle Surface Combustion furnace with a walking beam type hearth conveyor for heating before forming. The heated blanks are pushed out of the furnace, one at a time, immediately formed while hot, then pierced for the necessary fastenings. The bars then are transported to the heat treat department. They are heated to 1525 F, then placed in fixtures and quenched in oil. This is followed by a tempering treatment at about 1000 F. From this operation they are taken to the plating department.

The first major step here is pickling and washing for removal of scale, oil and dirt. The bars then move on a monorail conveyor to the polishing

While the polishing machines take care of most of the surface of the bar, the ends require individual polishing. This is done on the polishing stands, shown here, using formed wheels.



room. Here they go through one of two similar automatic polishing machines in which the entire surface of the bar is polished, except for the turned-in ends. When the bars leave the automatic polishers they go to a battery of polishing stands where the ends are polished by hand, using wheels grooved to the contour of the bar.

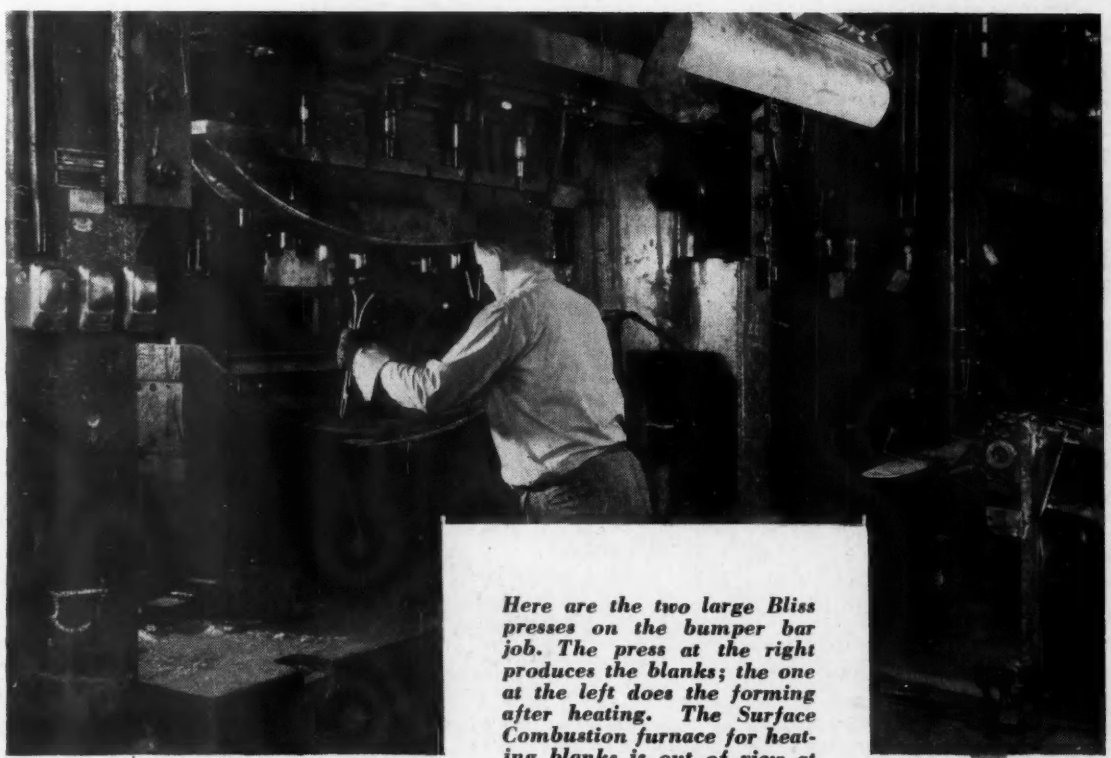
The work now is ready for nickel plating. For this purpose there are two parallel Meaker units of automatic type, fitted with an automatic conveyor system for transporting the bars through the unit and for transferring bars automatically from the conveyor to the immersing mechanism in each tank of the unit. The sequence of operations in each unit is as follows: Mechanical washer, electric cleaner, cold rinse, acid dip, cold rinse, cold rinse, cyanide solution for copper plating, cold rinse, nickel plate, cold rinse, hot rinse. The final hot rinse is intended primarily to leave the work dry as it leaves the plating unit.

Each of the nickel plating units is served by a battery of four motor generator sets each having an output of 15,000 amp per unit. The nickel plating solution is a mixture of 42 oz/gal of nickel-sulfate, four oz/gal of nickel-chloride, and four oz/gal of boric acid. The solution is held at a temperature of 140-150 F; pH is maintained around 2.1. Current density is held at 62 amp/sq ft. It is of interest to find that the total load for each unit amounts to 224 bumpers.

From nickel plate the bumpers enter the buffing room. Here again is a set-up of a long automatic buffing machine which takes the entire exposed area of the bar in one operation as in the case of the polishing machine. Again, the bars go to individual stands for buffing the turned-in ends. After buffing the bars are ready for chromium plating.

Since the chromium plating procedure is relatively unchanged, the chief feature of the new department is the introduction of increased plating capacity in the

Setup for Plating Bumpers



Here are the two large Bliss presses on the bumper bar job. The press at the right produces the blanks; the one at the left does the forming after heating. The Surface Combustion furnace for heating blanks is out of view at the extreme right, only the exit end of the pusher conveyor being visible at the right.

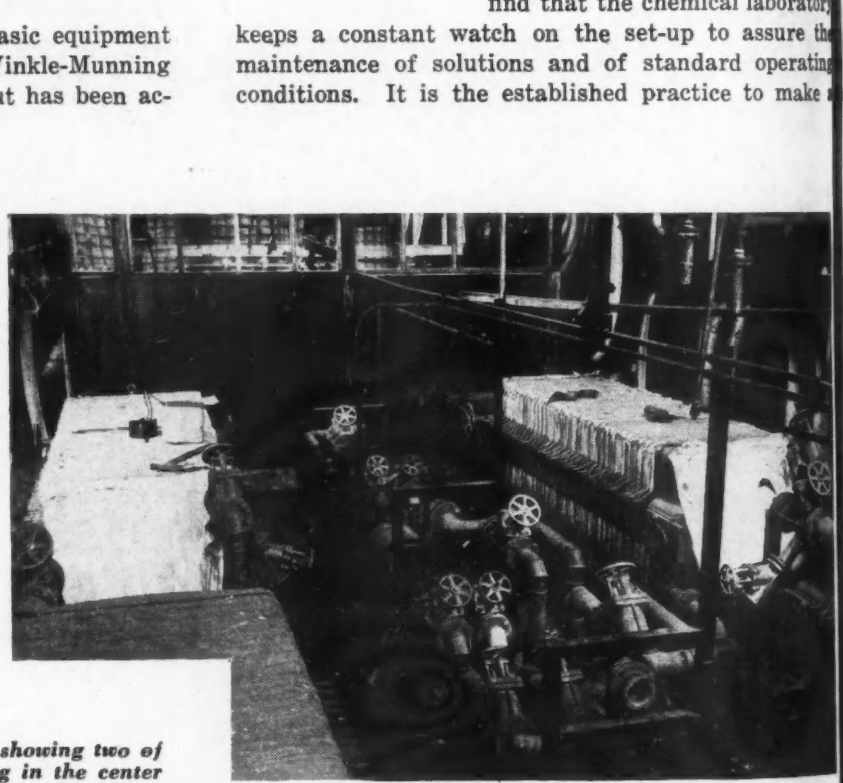
Following the pickling operation, bars are polished on these long, continuous automatic polishing machines on horizontal fixtures, one of which may be seen in the foreground at the right.

form of longer tanks. Some of the basic equipment such as the original Hanson-Van Winkle-Munning plating equipment remains the same but has been accommodated to the larger unit and modernized by the installation of the new mechanized automatic conveyor system. The sequence of events in this unit is as follows: Electric cleaner, cold rinse, acid dip, cold rinse, chromium plate, cold rinse, hot rinse. The cycle in the chromium plating machine is around 12 minutes, producing the usual "flash" coating of about 0.00001 in. in thickness.

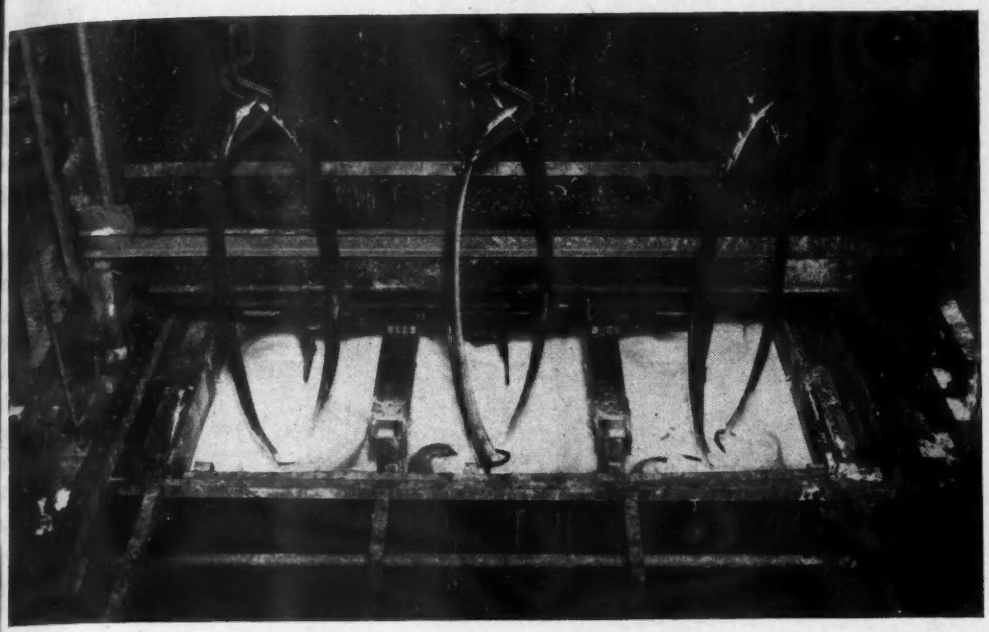
The chromium plating solution is made up with 33 oz/gal of chromic acid and 0.50 oz/gal of chromium-sulfate. Current density is maintained at 150-200 amp/sq ft. The motor generator set for this unit has a capacity of 10,000 amp. As a matter of interest it may be noted that the plated area of the bar is about 6.2 sq ft per bar.

Immediately upon leaving the plating department, the bars move into the adjacent room on the monorail conveyor, proceed to the DeVilbiss water back spray booth where the inside surface of the bar is sprayed with a coating of aluminum paint. Continuing on the monorail the bars are transported to an overhead oven for baking this finish. As they emerge from the baking oven they are ready for packing and shipment to assembly plants and parts warehouses.

Since plating quality is the main objective of the entire operation, it is not surprising to find that the chemical laboratory keeps a constant watch on the set-up to assure the maintenance of solutions and of standard operating conditions. It is the established practice to make



A corner of the filtering room showing two of the filter presses. The plumbing in the center is mostly lead piping and lead-lined fittings for handling actively corrosive solutions. The chromium plating unit is located directly in the background.

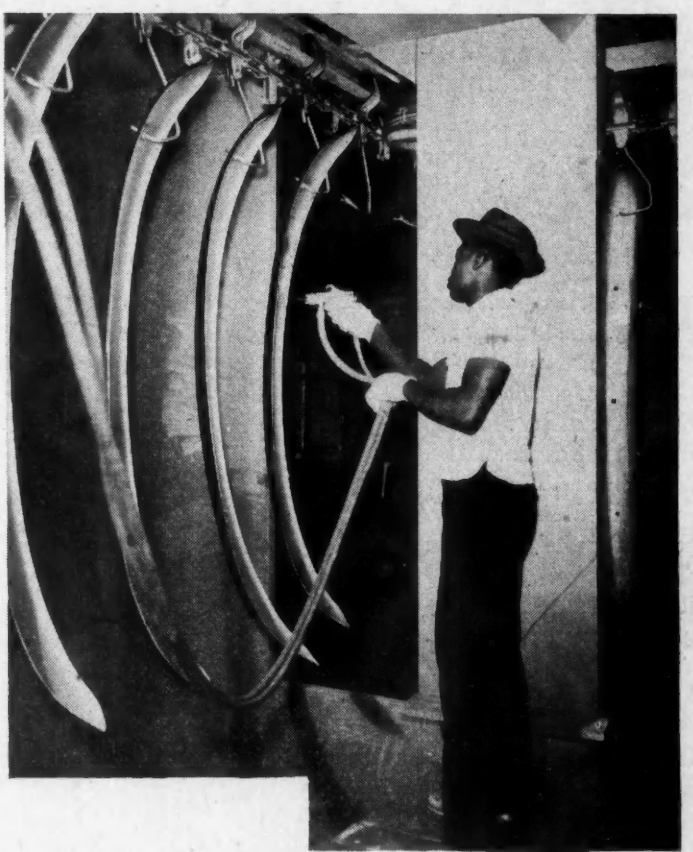


This is a view looking down on a section of the chromium plating unit, the chromium tank being in the background. The chain conveyor traversing the unit may be seen at the sides, while the immersing mechanism is directly overhead, carrying the bumper bars.

complete chemical analysis of each solution twice a week, regularly. For this purpose, samples of the solution are taken from each tank and delivered to the laboratory for analysis. In the event of trouble or of questionable quality at any stage, tests will be made oftener and as often as necessary.

The plating department is served by a central filtering room containing a group of filter presses, one for each type of chemical solution. The solutions are piped to these presses and recirculated so as to keep them clean and free from accumulated impurities. This procedure contributes further to the high level of quality demanded by Chevrolet.

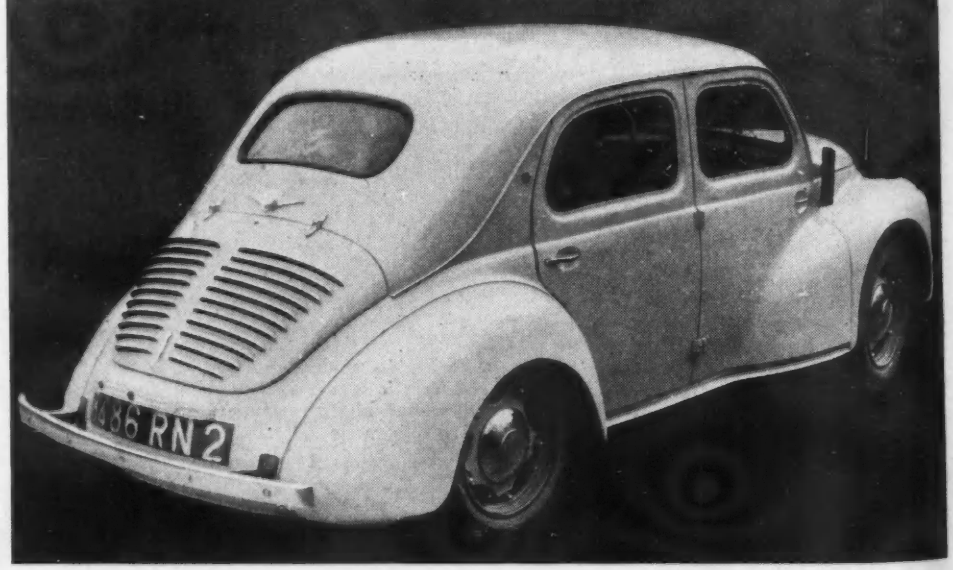
This operation is an interesting commentary on the advancement of the electroplating art and the role of the chemist and metallurgist in constantly improving the quality of the product.



Interior of the water-back type DeVilbiss spray booth in which the inner surface of the bars is sprayed with aluminum paint while the work moves along on the overhead monorail.

General view of the cars on display in the Grand Palais at the thirty-third showing of the French Automobile Salon. This is the first Paris exhibit since the beginning of the war. (Acme photo)

STAGED in the elegant Grand Palais on the Champs Elysées, still bearing the scars of the street fighting of 1944, the French Automobile Salon is admittedly an excellent display doing credit to the energy and determination of the national industry. Whether such a show should have been held so soon after the liberation is a matter of discussion. Some see in it useful propaganda; a proof of what the industry can do and intends to do in the near future. Others describe it as a theatrical gesture, a waste of money, at a time when the country is face to face with stern realities.

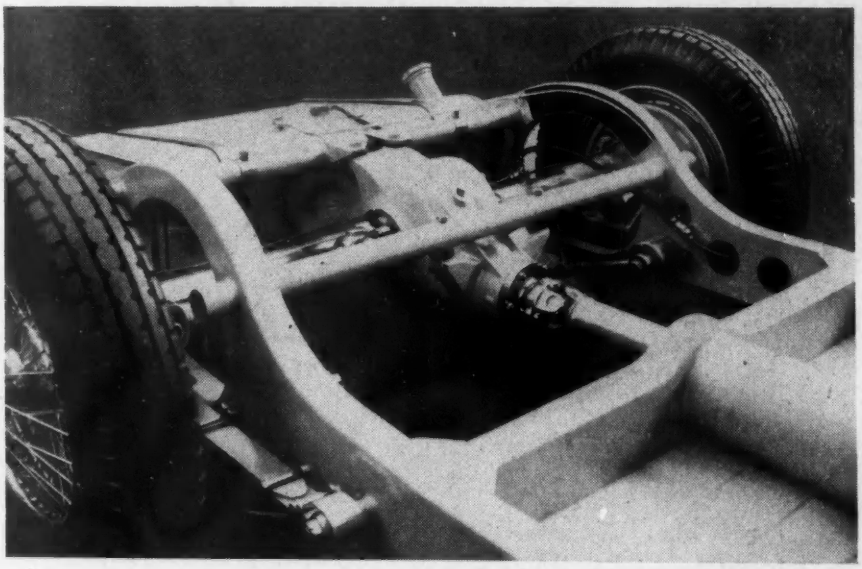


Rear view of the Renault four-passenger sedan showing the louvers in the hinged hood through which the cooling air for the rear engine is discharged.

the Paris Show

By
W. F.
Bradley

Special correspondent of AUTOMOTIVE *and* AVIATION INDUSTRIES in France.

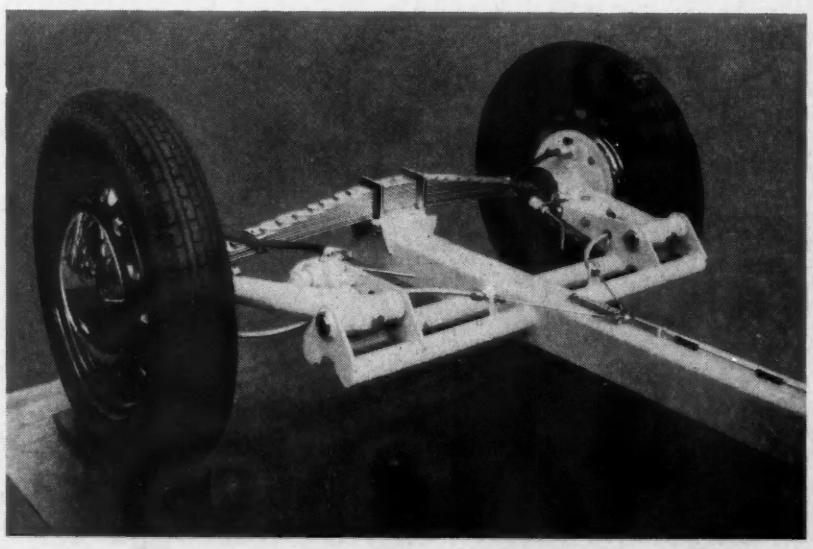


Rear suspension of the Delahaye six. The frame is channel-section with welded cross members. DeDion type shafts pass through the side rails for the rear-wheel drive.

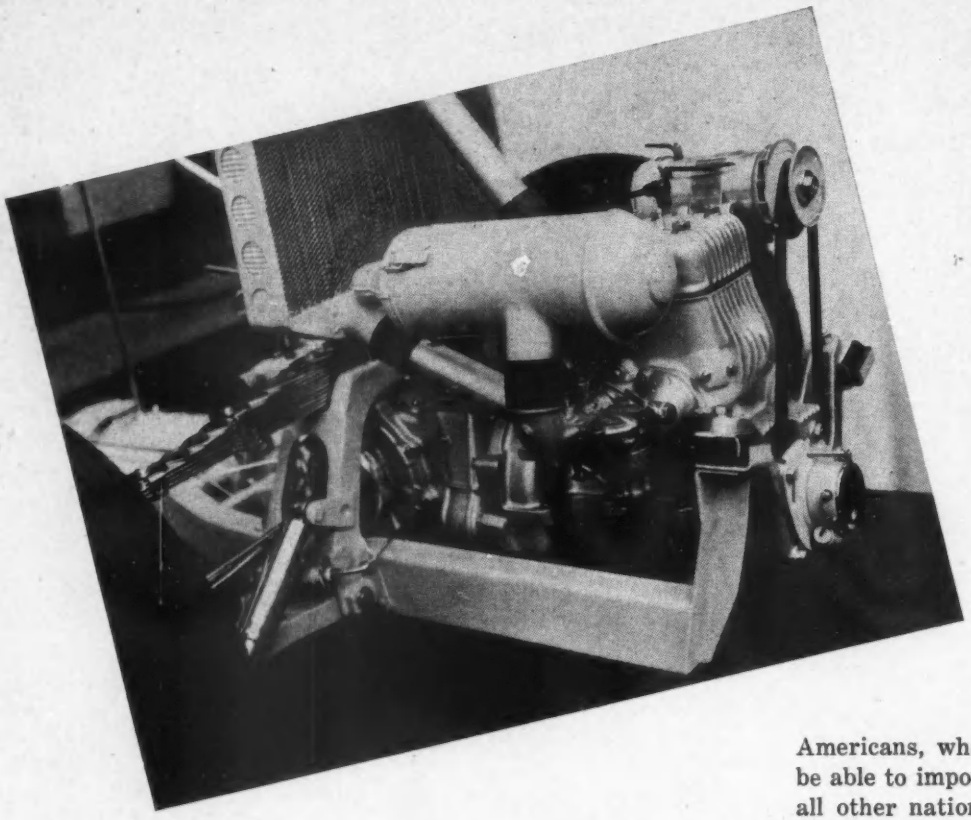
One explanation of why a show was staged when there is no production for the home market and not enough for export, when delivery dates are in the distant future and prices are vague, is that if the industry had not stepped in as usual, the State would have grabbed an exhibition which for 33 years has been run by a unity of groups of manufacturers. Already the State is in possession of Renault; and Renault having bought S.R.O. ball bearings, this organization also becomes State-owned. Berliet probably will be taken over in a few weeks time. To allow the Government to capture the Salon—the pride of the French motor manufacturers—would have been a disaster.

There is much discontent at the attitude of the Government towards the automobile industry, but for this discontent to be expressed by M. Lefaucheux, general manager of State-owned Renault is really surprising. Lefaucheux maintains that raw materials are badly distributed, the railroads and other privileged bodies getting so much that they can do black market trading with it; that prices are too high by reason of restricted production; that the home market should be developed; and that the high cost of gasoline is crippling all road transportation.

A prominent Peugeot official maintains that of 1600 machine tools recuperated from Germany 1200 went to Renault and Berliet, leaving only 600 for the re-



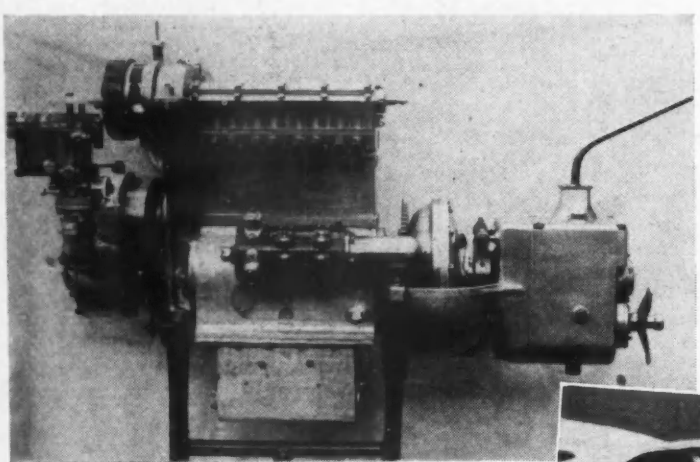
The Skoda rear assembly showing the backbone frame construction and the wheel suspension of a transverse spring and two radius arms anchored by the transverse welded steel tubes.

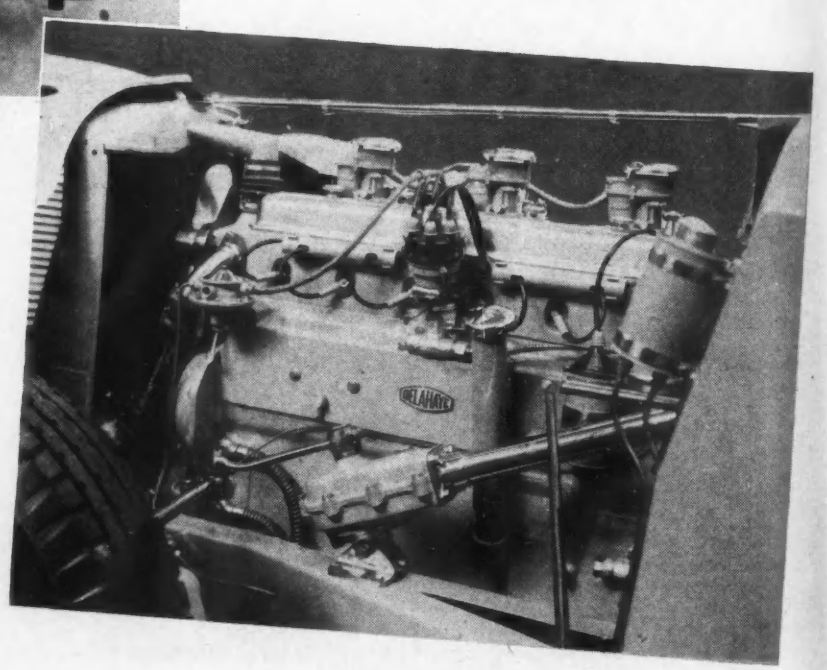


mainder of the manufacturers. It is claimed that the State-owned railroads have stocks of raw material sufficient for two years, while automobile manufacturers are months behind on their deliveries. State control was necessary in the confused period which followed the liberation, but it is now time for it to be removed in a very large measure, if not entirely. To dictate to manufacturers which types of vehicles they shall build, whether the plant is suited for that class of vehicle or not, is described as madness.

Briefly, the Paris Salon is highly interesting as a sample show. It has attracted about one dozen Americans, who do not know when they will be able to import cars but, with one exception, all other nations are absent. It is a display of what France hopes to offer to buyers.

The People's Car—a French version of the German volkswagen—was a natural development of the postwar period. It is offered by Renault, who gives promise of deliveries about August next. This factory, now the largest in Europe, is obviously well placed for producing a cheap car in quantities. The four-passenger, four-door sedan has a wheelbase of 92½ in., rear wheel drive, no separate chassis and is independently sprung all round on coil springs. The four-cylinder engine has a 46.4 cu in. displacement, with a 2.16 in. bore



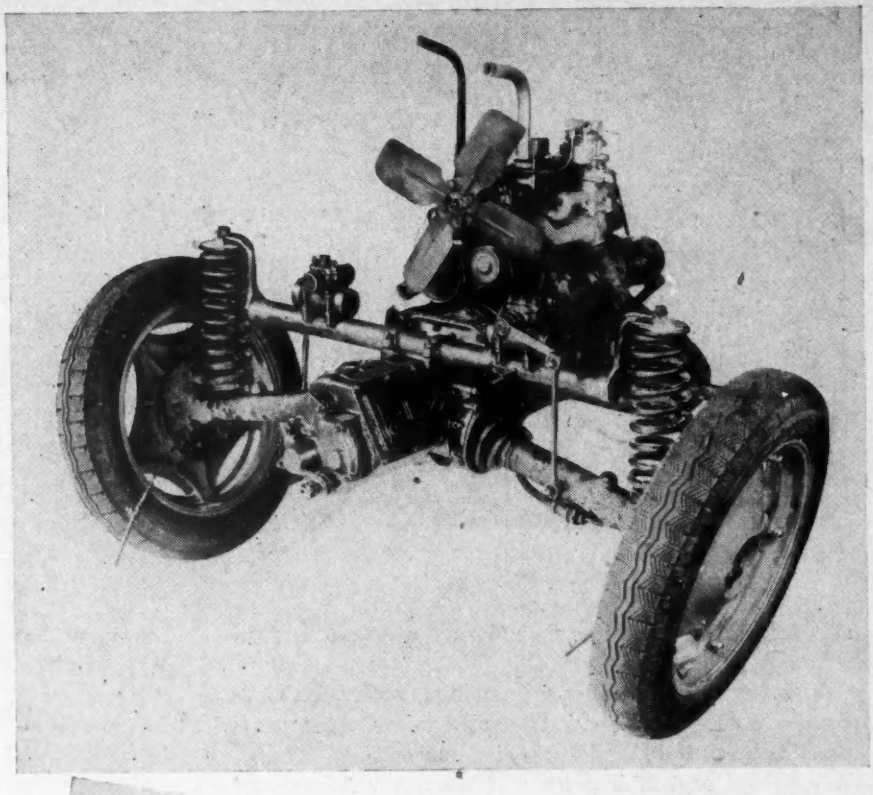


(Top of page) Front view of the Skoda chassis showing the forks to receive the vertical, four cylinder, overhead valve engine.

(Above) The 21.35 cu in. displacement Bugatti four-cylinder engine has two overhead camshafts, a Rootes-type blower and a four-speed transmission. It is designed to operate at 8000 rpm.

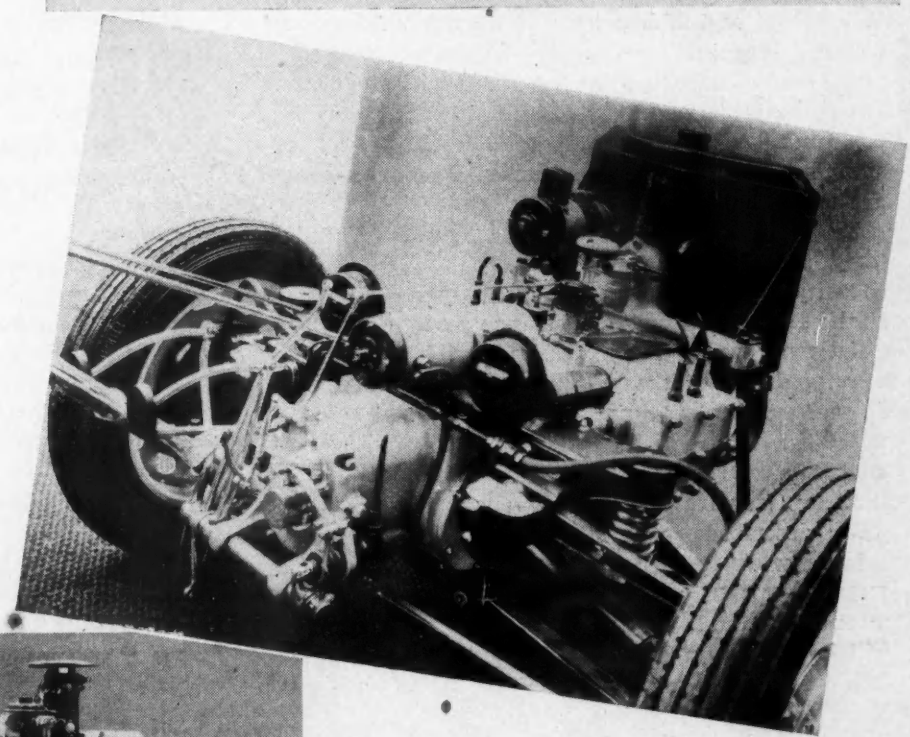
(Right) The high-powered Delahaye car features a new six-cylinder engine using three carburetors. Dubonnet suspension is used in the front.

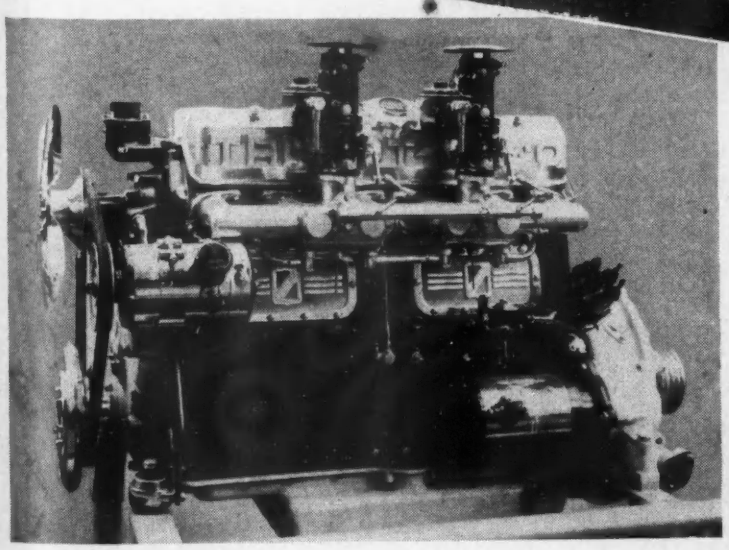
The Renault rear assembly of the four-cylinder 46.4 cu in engine, the rear wheel drive and independently sprung wheels.



and 3.15 in. stroke, and develops 19 hp at 4000 rpm. Steering is by rack and pinion. Maximum speed is 55 mph and maximum torque is 34.6 lb-ft at 1500 rpm.

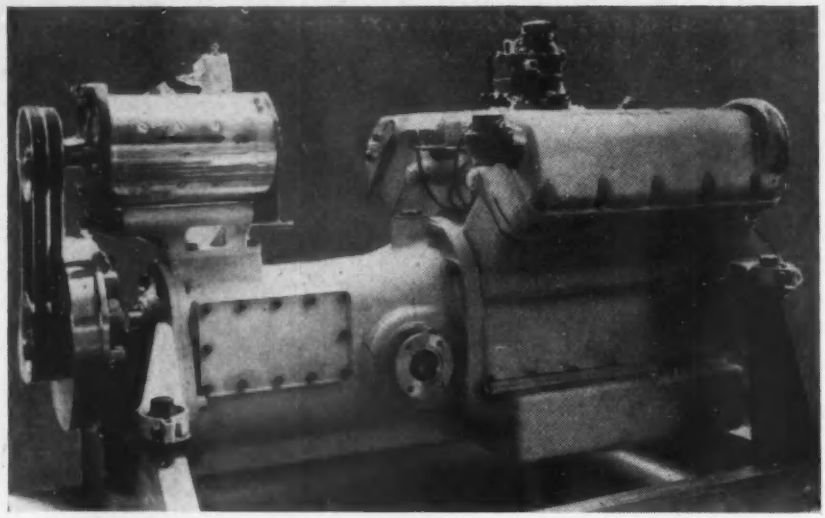
The cylinders are a single casting with detachable iron sleeves, the head is aluminum alloy with overhead valves and bronze seats and the three main bearings are interchangeable. A downdraft carburetor, with a hot spot, is used, full pressure lubrication is used, and cooling is by a belt driven combined water pump and fan through a radiator just ahead of the engine. Air is taken in through a slot where the rear fender joins the body and is discharged through slots in the rear hinged hood. The pump drive is taken from the camshaft. At the opposite end the generator drive is taken by belt off the crankshaft. The transmission has three speeds, with second and third synchronized, and final drive is by spiral bevel gear through two universally jointed half shafts to the rear wheels. The entire unit is mounted on four rubber blocks. Exhaust box is set across the body at the rear and the six-volt battery is under the hood by the side of the engine. Controls —choke, starter and change





(Above) Front end power unit of the Bernard Freres. The engine is a flat four of 48.8 cu in. displacement with cylinders and crankcase in one casting of light alloy. Steering and accessories are mounted directly on the power plant so the entire unit may be withdrawn for repairs.

(Left) Two camshafts and valves in the head are used in the Talbot 274.5 cu in. engine which is stated to develop 170 hp at 4200 rpm.



The Claveau engine is of light alloy castings and designed for front wheel drive. It is a Vee-eight, and drives through a five-speed transmission.

speed lever are on the floor between the two front seats.

Front suspension is by coil springs, with wishbones. Under the forward hood, the spare wheel is mounted vertically and behind this is space for baggage. Wheels are of the detachable rim type with five lugs for attaching to the wheel spider, the whole being of pressed steel. The body forms a unit with the chassis, the platform being one piece with transverse ribs of 0.059 in., to which the two 0.0276 in. sheet steel body stampings are welded. Lockheed hydraulic brakes are used.

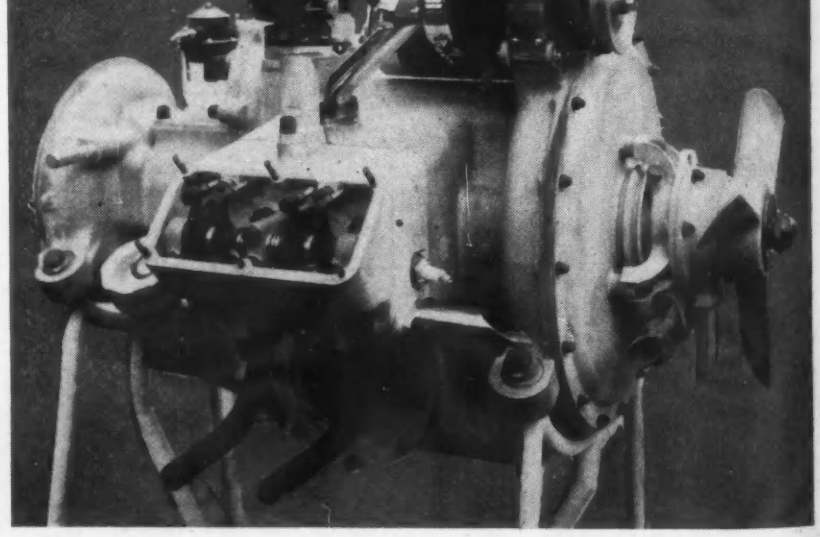
The Renault appears to be the only cheap car likely to be produced in quantities. A car of similar load capacity has been tested out by Citroen, but it is not at the show. The only comment made by Citroen officials was "we are not allowed to build it, and if we were, we have neither the labor nor the material to do so." Citroen thus continues with the two front-wheel drive models, a four and a six.

J. A. Gregoire's light alloy design, described in the January 1 issue of AUTOMOTIVE AND AVIATION INDUSTRIES, was shown on the inventor's stand, but probably it will be two years before it is put into production by the French Fiat. Meanwhile, Panhard has taken a license for the Gregoire and is producing it as a four-door, four-passenger model, with numerous detail modifications from the original design. Among the changes is the use of torsion bars for valve springs.

All the other light cars are interesting as designs, but have no big production programs back of them. The Mathis 3-wheeler, April 1 issue of AUTOMOTIVE AND AVIATION INDUSTRIES, will only get into production when the necessary plant has been received from the United States. Bernard Frères show a well designed, light alloy, flat four of 48.8 cu in. displacement, with cylinders and crankcase in one casting, overhead valves with pushrods, timing gear housing having the water pump cast with it, one belt drive for water pump and generator, all accessories mounted on the top of the engine and front-wheel drive through a four-speed transmission. Wishbones and coil springs are used and the power plant has the steering mounted directly on it, so that the entire unit can be withdrawn for change or repairs.

George Irat also has a flat four in light alloy, with 2.84 in. bore and 2.64 in. stroke, nitrided sleeves and Alpax head. The four-speed transmission is a unit with the engine, and front wheel drive is employed. The weight of the three-seater, with a wheelbase of 91 in., is 1100 lb. These people show a prototype of a combined body-chassis formed of 10 cast-magnesium elements assembled by bolting, and designed to receive a sheet aluminum covering. It is a two-door job, built to receive the flat four engine, and is stated to weigh 175 lb. It has independent suspension in front,

(*Turn to page* 60, *please*)



The light alloy, flat four engine designed by George Irat for front wheel drive has nitrided sleeves and an Alpax head.

Industry Profits Declined

(*Continued from page* 17)

rather intemperate in its demands, but still it seems to us that you wouldn't miss 300 million dollars out of 4 billion dollars very much."

Perhaps the most striking statistic is the fact that when the general public is asked what rate of profit it considers fair for business, the average answer is about 10 per cent, and when you ask them what per cent they would consider typical, the answer is almost 20 per cent. Very few persons distinguish between profit rate based on sales, and profits as a percentage of invested capital. The fact is that the actual percentage profit on sales after taxes averages less than 4 per cent.

It seems obvious from surveys of public opinion that the actual profit level the public considers fair is a good deal higher than that which industry enjoys, but the trouble is that the public thinks industry is making many times the profit it actually is.

Attempting to educate employes by simply stating the facts is often rather dry and seems like self-pleading. Moreover, it may appear to imply that the employer thinks the employe is ill-informed.

One astonishing thing is the substantial number of persons who are in fairly important executive positions but are not connected with the detailed financial operations of the company who have entirely distorted ideas about the relationship between wages and profits and other relative basic economic factors. There is some reason to believe that the educational program should start from the top. General Motors is making an attempt to deal with this problem in its *Executive Bulletin*, which goes to all management, including factory foremen. These articles show what the public believes contrasted with the actual facts revealed by official government records.

Leonard P. Ayres, nationally-known economist, writing in the September, 1946, issue of the Cleveland Trust Company Business Bulletin, contrasts the facts about manufacturers' profits with the general public concept in the following words: "During the past 18 years, American manufacturers have made about 3.2 cents of profits from each dollar of sales. This conclusion is derived from a recent study of corporation finances published by the Department of Commerce.

"That rate of profit is lower than most people would have supposed, but it must be remembered that the figures cover all manufacturing, and so include the operations of many concerns which made no profits in many of the years as well as the returns of those which did succeed in making profits. The data used are those compiled from the income tax returns of the corporations and the profits are after the payment of state, local, and federal taxes."

The chart with this article shows the data mentioned by General Ayres on actual profits. These are compared with the most recent opinion polls, showing what the public thinks profits are and what profits should be.

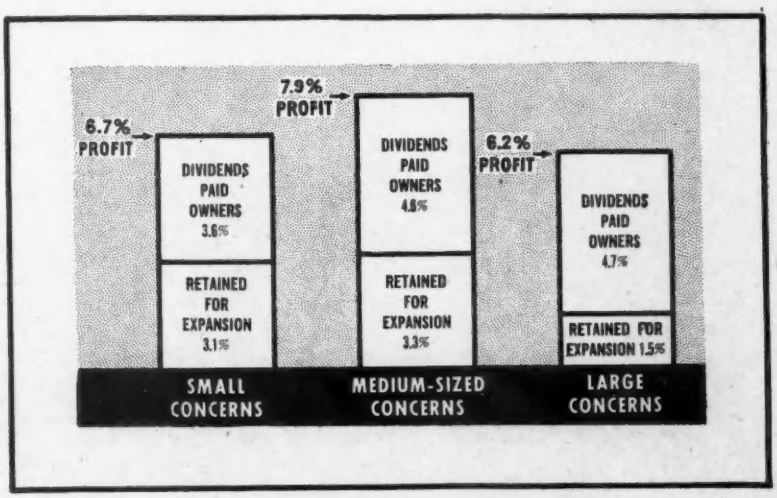
General Ayres continued: "Average size of profits per dollar of sales is not as astonishing as the great variability of them from year to year. Corporation prosperity was greatest in 1929 when the manufacturing concerns made 6.25 cents per dollar of sales.

"The great crash of stock prices came in the autumn of that year, and in 1930 profits per sales dollar fell to 2.25. That was the beginning of the Great Depression, and in 1931 there was an average deficit of 1.14 cents, and in 1932 a still worse loss of 4.6 cents per dollar of sales."

In the years following that worst period of depression, General Ayres pointed out, profits per dollar of sales increased with considerable rapidity, and in 1936 they amounted to the relatively good figure of 5.14 cents.

"That high level was of only brief duration, and in 1938 the rate of profit was only 2.26 cents," General Ayres stated. "That was a year of real depression, and widespread unemployment."

"Since 1941, and all through the war period, there has been a steady decline in the cents of profits per dollar of sales. From a high level of 6.19 cents in 1941 the profit declined to 3.21 cents in 1945. Preliminary estimates, which in the nature of the case must be only tentative, and which are not a part of the official computations, indicate a still lower profit rate for 1946. The average for the four war years of 1942 through 1945 is 3.56 cents of profit for each dollar of sales. It is a most moderate profit figure for wartime. . . ."



Medium sized businesses show the highest profits. Here the comparative profits of large and smaller concerns are based on dollar sales compiled from U. S. Treasury reports.

Aluminum

By George B. Grim
Research Engineer, Caterpillar Tractor Co.

EARLY in 1946, Caterpillar Tractor Co. began to use aluminum bearings on all crankshaft journals in several models of production engines. As rapidly as sufficient supplies of the new type bearings could be obtained, they replaced the earlier bearings in other production models so that all models are now built with aluminum bearings on all crankshaft journals.

This change is the result of development work which began eight years ago when Caterpillar started a search for bearing materials better than those then in use. In addition to the fact that normal expected bearing life was shorter than could be desired, horsepower ratings were being increased by increasing the rated speed and rated piston loading, while journal and bearing sizes could not be increased due to space limitations. The result of this trend was to produce bearing loads very close to the safe limit of capacity.

It was decided to evaluate the relative merits of various materials and several available bearing metal combinations under various conditions of load, temperature, and oil condition. Some of the materials failed at elevated temperatures, some corroded badly, some simply did not carry greater loads than were being imposed on the standard babbitt bearings.

At about the same time, reports of work with aluminum bearing material in Germany and England appeared in technical journals, so it was decided to investigate this type of bearing for heavy duty engines. Tests, at Caterpillar, of the aluminum bearings showed evidence of high load capacity, high temperature resistance, corrosion resistance and low wear rate.

The aluminum alloys in use in Germany were relatively hard (approximately 120 Brinell Hardness Number), but the English alloys were appreciably softer. Early investigations led to the conclusion that the softer alloy was superior for nearly all bearing purposes. German bearing alloys contain cobalt and magnesium, both of which tend to increase hardness; British alloys contain some magnesium but are higher in tin content. Due to the hardness of those bearing alloys some trouble with journal wear and with scoring under conditions of border line lubrication is experienced. The alloy now in use by Caterpillar Tractor Co. is softer than either the German or English alloys, which factor eliminates the crankshaft wear and scoring troubles, sacrificing none of the load carrying and bearing wear resistance characteristics.

Resistance to high temperature and corrosion seems to be approximately equal for all aluminum alloys which are acceptable for bearing purposes. Continued improvement of the alloy and of processing methods has increased the yield strength to 15,000 psi minimum, without sacrificing other characteristics.

The first material tried was similar to that reported by Rolls-Royce Co. in English journals. This aluminum alloy contained approximately 6.0 per cent tin, 1.5 per cent nickel, 0.75 per cent copper, 1.0 per cent magnesium, 0.2 per cent silicon, and 0.3 per cent iron. Research on materials led to an alloy containing 6.5 per cent tin, 1.0 per cent nickel, 1.0 per cent copper, and 0.5 per cent silicon. This material showed highly satisfactory service conditions in all normal applications. Recent investigation has shown the superior anti-

Fig. 1 — Aluminum bearing halves after 6000 hours of operation in an engine at rated power and speed.

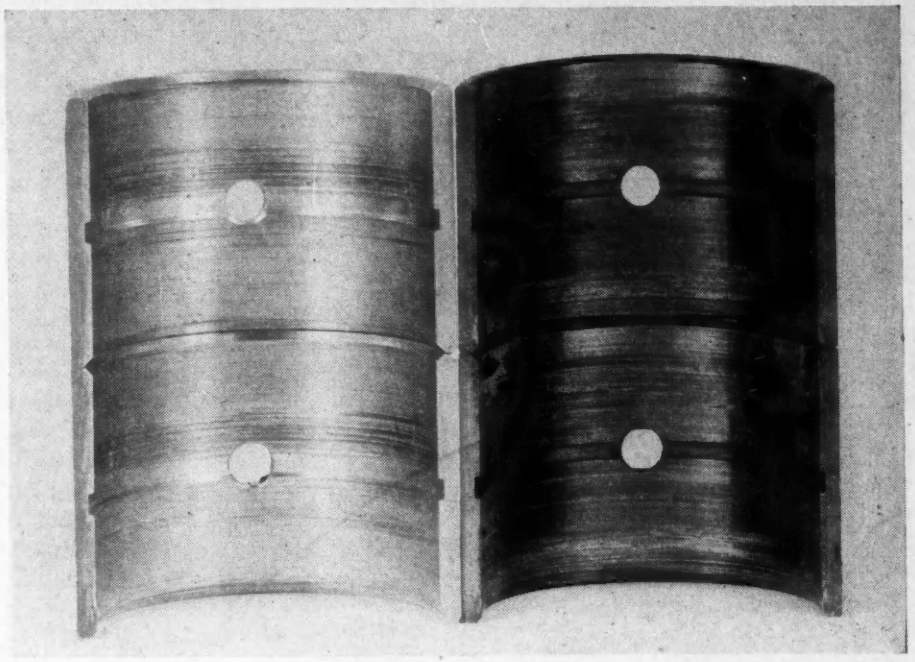


Fig. 2 — Connecting rod bearings after fatigue machine tests. (Left) Aluminum alloy bearing shells; (Right) Bronze-backed babbitt shells.

Bearings *for Caterpillar Engines*

scoring quality of silicon under conditions of heavy load and border line lubrication. This is important during the starting period before lubricant flow is fully established. Hence, the material now in use contains approximately 2.5 per cent silicon while nickel has been reduced to a minor constituent.

The new bearing material was developed by the Aluminum Co. of America with whom Caterpillar Tractor Co. worked very closely during the development period. Interest in the aluminum bearing material was mutual, with the result that much co-operative work was conducted.

A test recently concluded demonstrated the resistance of aluminum alloy bearings to seizure, galling, and scoring during the period of starting the cold engine before oil flow is fully established. In making the test, the oil was drained from an engine after stopping, while it was still hot, and the engine was allowed to cool over night. In the morning, it was quickly started, run idle for two minutes, then the oil was poured into the crankcase so that normal oil pressure was established. Several series of such starts were made at various engine speeds up to rated high idle, with an inspection after each series. Each inspection found all bearings in perfect condition. It is felt that no more severe starting condition would be encountered in any type of normal service.

The first bearings were made from sand castings from materials very similar to piston alloys. Through the combined efforts of the Aluminum Co. of America and Caterpillar Tractor Co., alloys and fabricating techniques were developed so that the alloy in use today contains approximately 7.0 per cent tin, 25 per cent silicon, and small quantities of nickel and copper. Permanent mold castings are now used exclusively and the material is cold worked before final machining to improve physical properties. Extensive corrosion tests of the various materials considered were responsible for the development of extremely high corrosion resistance. Before releasing aluminum alloy bearings to regular production, many thousands of hours of testing of experimental bearings in laboratory engines and in customers' machines were observed. The only failures reported were due entirely to incorrect fitting of the bearings in their seats.

Whereas, as our experience has shown, babbitt bearings in heavy duty service normally have a life expectancy of 3000 to 4000 hours, the life of aluminum bearings is several times that length. In fact, we have not run any set of bearings long enough to establish an expected limit of their life, although some have operated for more than 10,000 hours and are still serviceable. Fig. 1 shows aluminum bearing halves which have operated for 6000 hours in an engine operated at rated power and speed.

Load carrying capacity of aluminum-tin is approximately twice that of babbitt. The latter type of bearing shows signs of extreme distress at 3500 psi while aluminum bearings have carried loads of more than 6000 psi before showing signs of distress. Fig. 2 shows a pair of aluminum connecting rod shells which ran in a fatigue testing machine for 24 hours carrying a peak load of 4400 psi at 2500 rpm with 200 F oil temperature. Shown in the same picture is a pair of bronze-backed babbitt shells which operated less than three hours under the same condition. It will be observed that the babbitt has been completely lost. The

(*Turn to page* 86, *please*)

Modern Production

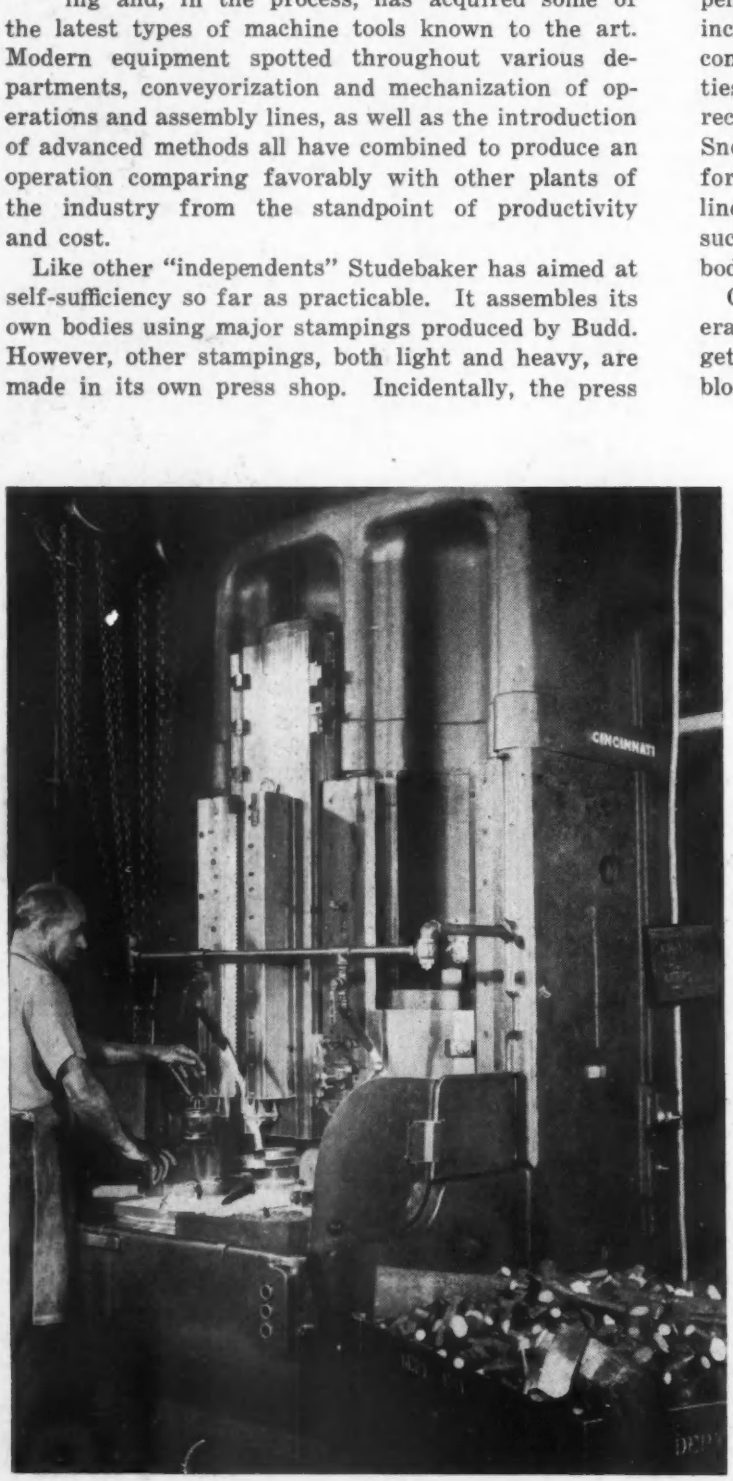
Conspicuous

THE Studebaker Corporation has done an outstanding job of converting to postwar motor car building and, in the process, has acquired some of the latest types of machine tools known to the art. Modern equipment spotted throughout various departments, conveyorization and mechanization of operations and assembly lines, as well as the introduction of advanced methods all have combined to produce an operation comparing favorably with other plants of the industry from the standpoint of productivity and cost.

Like other "independents" Studebaker has aimed at self-sufficiency so far as practicable. It assembles its own bodies using major stampings produced by Budd. However, other stampings, both light and heavy, are made in its own press shop. Incidentally, the press shop boasts a battery of new Clearing presses and a 500-ton Bliss press of latest design. Front end suspension for all models is made from scratch and this includes the making of springs—an old art with the company dating back to the wagon days. These facilities are rounded out with a large cast iron foundry recently modernized to include an extensive Bartlett-Snow sand handling installation, large sand slingers for the two block lines, and mechanized conveyor lines. The foundry produces all of the gray iron parts such as blocks, heads, bell housings, water pump bodies, bearing caps, miscellaneous brackets.

One of the interesting features of the foundry operation—quite unique, in fact—is the use of a "target" fixture at the end of the block line. Finished blocks must line up in this fixture well enough to clean up the locating pads which are milled to suit the fixtures on the machine line. This makes for an unfailing index of foundry quality. If a block does not clean up prop-

This is the 123rd in the series of monthly production features



(Left) As mentioned in the text, Studebaker has tooled a large number of operations on the latest types of Cincinnati Hydro-Broaches. This is a Duplex Hydro-Broach for surface broaching the three faces of the Tee-shaped steering knuckle support arm bracket. The work table features two indexing fixtures, one for each slide.

(Right) An example of improvisation — the conversion of a standard machine to a special purpose job is seen here. This is a standard Barber-Colman hobbing machine, with overarm removed, and with the necessary attachments added for chamfering flywheel gear teeth.

Equipment

at Studebaker Plant

By Joseph Geschelin

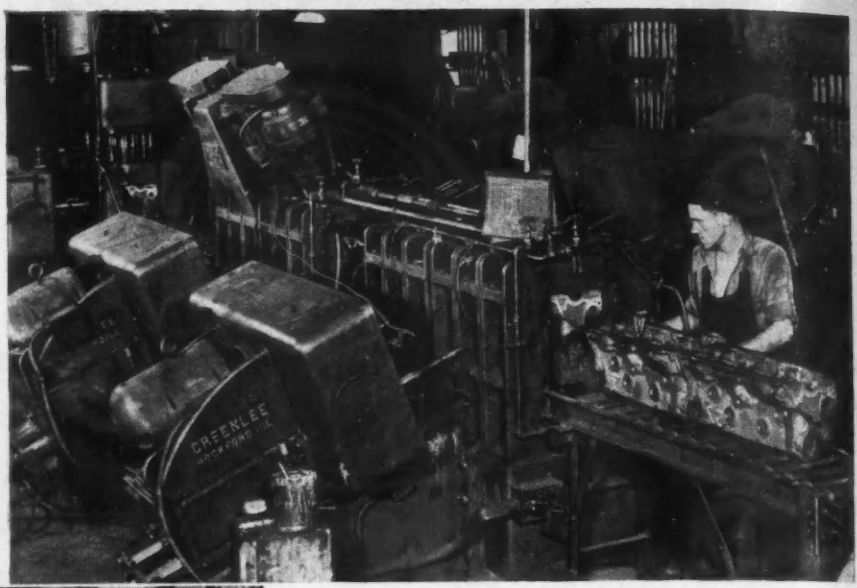
erly it becomes foundry scrap, thus relieving the machine shop of much of its usual headaches.

The then new Champion engine line was described in this publication back in 1939 when the line was first placed in operation. Today Studebaker has made important changes in equipment and in process based upon its wartime experience as well as the availability of modern techniques. One of the basic changes, affecting the tooling of connecting rods, is incident to the adoption of the precision-type thin-shell bearings, replacing the former practice of spinning-in babbitt. The new procedure is described later in this article.

The cast camshaft (CWC Proferall process) department has been re-tooled and contains a great deal of new equipment including some new Landis grinders and a battery of the fully automatic Norton Cam-O-Matic grinders. The crankshaft line boasts a large battery of modern LeBlond lathes,

(Above) One of the most modern pieces of equipment in the engine department is this Micromatic vertical Hydrohoner tooled for the honing of connecting rod big ends. The machine has an automatically indexing six-station table and two spindles. The two machines on this line are provided with the Barnesdril automatic magnetic chip separators for keeping the coolant clean, and a Westinghouse refrigeration cabinet for holding uniform temperature of the coolant.

(Right) Drilling of holes in the front and rear faces and the drilling of oil galleries in the cylinder block is done in this Greenlee horizontal two-way, four-station transfer machine.



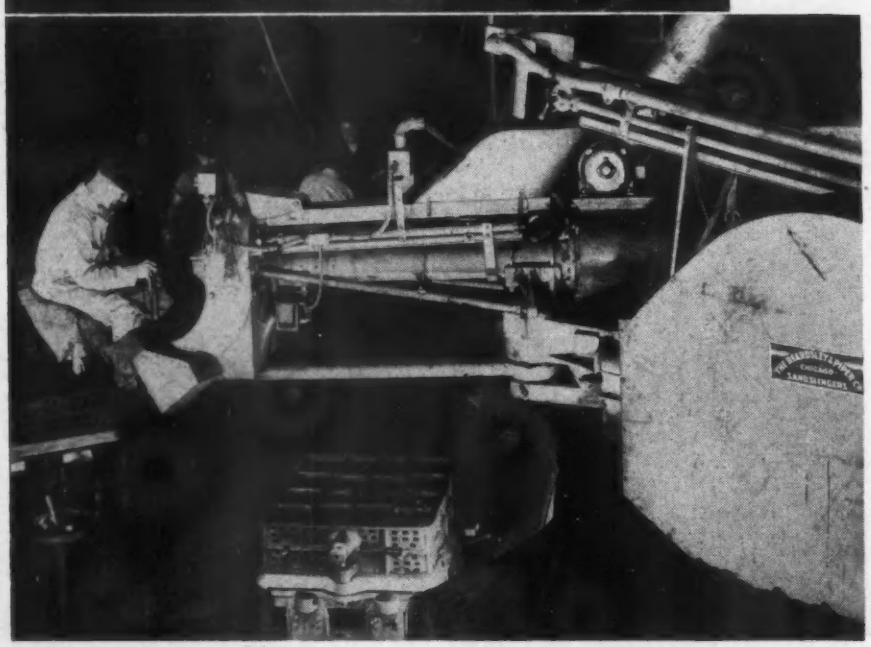
(Below) Another example of modernity is this three-wheel Hanchett surface grinder used for finishing the top and bottom faces of the bell housing in two stages. The rotary work table holds eight pieces at a time — four for the top, four for the bottom.

large Landis IW four-wheel type hydraulic grinders with on-the-nose sizing; an enormous Cincinnati milling machine for locating spot milling; and Tinius-Olsen balancing machines.

Two modern techniques of general interest to the industry have had wide exploitation in this plant. The first of these is the art of surface broaching. Using the familiar Cincinnati Duplex vertical Hydro-Broach equipment, Studebaker has extended surface broaching to a variety of parts. The other is the technique of induction hardening. For this purpose they have a number of General Electric induction heating machines for selective hardening of a variety of component parts.

So far as conveyorization is concerned, they have installed about five miles of conveyors in the machine shop and assembly building alone.

Although in principle the Studebaker front end suspension system for 1947 follows the same pattern as in previous models, changes have been made in the detail parts and in front spring design. To take full advantage of this unique suspen-



(Left) In modernizing the foundry, Studebaker installed two enormous sand slingers made by The Beardsley & Piper Co., of Chicago—one for the Champion block line, the other for the Commander block. The flasks are mounted on a three-station merry-go-round table in the floor, as shown.

pension system, the engineering department has been insistent upon precise alignment of the suspension as an assembly and in its installation in the chassis frame. To carry out this principle, the company has installed two enormous frame drilling machines which were built to specification by Snyder Tool & Engineering Co. Just prior to the mounting of the front end suspension, the frames go to these machines for the accurate jig drilling of 29 fastening holes in one operation.

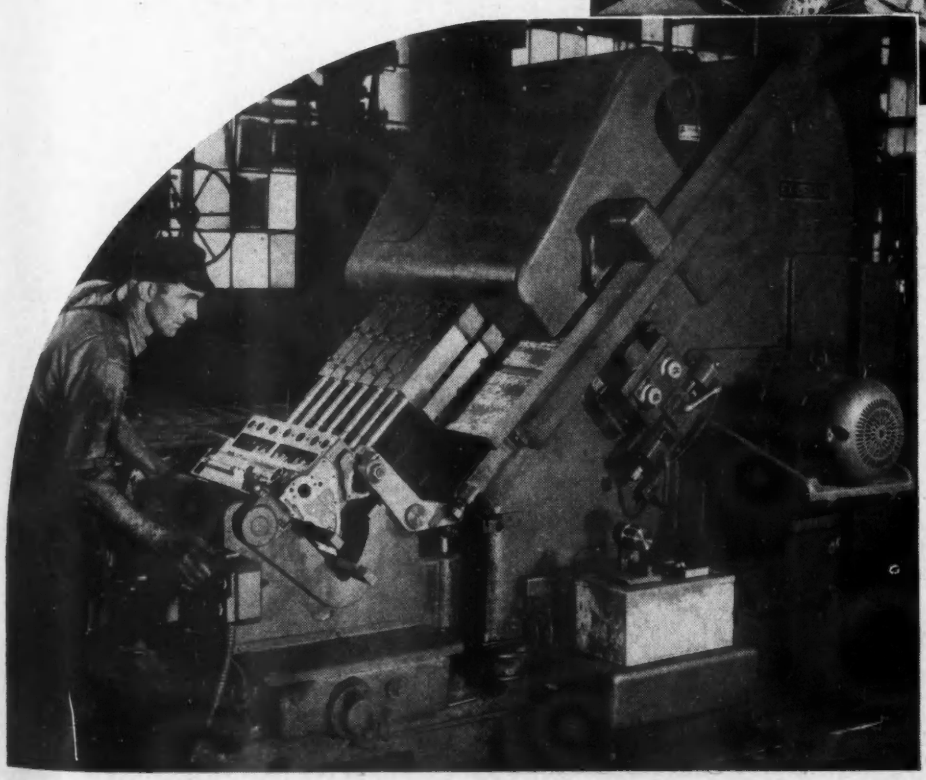
Wherever possible, cemented-carbides of the proper grade are used for metal cutting with single-point tools or with milling cutters. The Cincinnati mill mentioned above takes advantage of the negative rake tool design used so extensively during the war. Many of the finishing operations with cemented-carbides are done dry.

Another side-light of interest to our readers is found in the increasing adoption of the Barnesdril automatic magnetic separator on grinders and honing machines. At the present writing Studebaker has equipped several Landis grinders on the camshaft line with Barnes separators; also the two Micromatic honing machines for connecting rod big-end honing. This attachment does an outstanding job of removing fine chips from the coolant and cutting fluid, keeping the machine clean, and keeping the grinding wheels and hones free of chips, all conducive to preserving the quality of finely finished parts.

Machine Shop Procedures

Let us consider connecting rod machining first, since that represents one of the major changes in the engine. The sequence of operations is outlined below for handy reference. The first operation is that of coining to size on a Toledo press. Note that the connecting rod alone has three major surface broaching operations—the broaching of sides of bolt bosses and bolt seats; cutting off the cap end; and finish broaching of the joint face of the rod and cap and chamfering of the cap.

Another important item of equipment is the eight-



(Above) General Electric induction heating and hardening units are used on a number of parts at Studebaker. Shown here is the set-up for hardening flywheel ring gear teeth. The water manifold for quenching the work is plainly seen in this view.

(Left) Three of the new Ex-Cell-O six-spindle, inclined head precision boring machines are found on the cylinder block line for the boring of cylinder bores, in preparation for final honing.

station Heald Bore-Matic for the rough-and finish-bore of the small and big ends of the rod. The machine has four pairs of spindles, the big end spindle having two sets of tools—one for roughing, the other for finishing.

At the end of the line, the big end is honed in one of the new Micromatic vertical Hydrohoners having two spindles and a six-station rotary indexing table. In the cycle it finishes two rods at a time. Unique feature of the machine is the provision for precise sizing of the bore, independently for each honing spindle. Since two rods are honed simultaneously and since each one may vary in the amount of stock to be removed, sizing becomes vital to the proper functioning of an automatic cycle. In operation, both spindles begin honing simultaneously, then one or the other will stop and collapse and hone as the bore is finished to size while the other continues until it has completed sizing. Then both spindles move out of engagement, the table indexes around and the operation is repeated.

Both machines are fitted with Barnesdril magnetic separators mentioned earlier and, in addition, have a Westinghouse refrigeration cabinet to maintain uniform temperature of the coolant. This is important since both the work and the tool must be maintained at a standard temperature if the fine tolerances are to be held.

CONNECTING ROD ASSEMBLY OPERATION AND EQUIPMENT

Coin to size—**Toledo Coining Press.**

Broach sides of bolt bosses, bolt seats and cut seats—**Cincinnati 5/42 Duplex Vertical Broach.**

Drill oblong hole, drill and ream piston pin hole, 6 at a time—**Greenlee Drill.**

Chamfer 1 side large hole—**20 in. Sibley Motor Driven Drill.**

Chamfer both sides of piston pin hole—**No. 2 1-spindle Leland. Gifford Drill.**

Cut off caps, broach, finish broach joint face of rod and cap and chamfer cap—**Model "G"—5 ton Cinn. Hydro Broach. Model "G"—1 ton Cinn. Hydro Broach. Both 24" stroke—Dual Ram.**

C'drill and drill oil holes—**Krueger Special Drill.**

Burr oil holes and break edge of rod—**Bench type vertical disc. grinder.**

Drill, ream and chamfer bolt holes in rod, drill, ream and chamfer bolt hole in cap—**Greenlee 1-way Horizontal Hydraulic C'sink and Reaming Machine with 5-Station Hand Index.**

C'bore 4 at a time—**Baker Drill with Multiple Head.**

Burr bolt holes in rod and cap—Motor driven speed head, multiple head.

Mill bearing locks in rod and cap—**No. 1—18 Cincinnati Automatic Mill.**

Grind joint face of rod and cap—**Porter Cable Disk Grinder.**

Wash and assemble bolts to rod—Tank and bench.

Assemble cap, rod and nut—Bench.

Tighten and check nuts with torque wrench—**Hycycle and Torque Wrench.**

Bore crank hole—**8-Spindle Davis-Thompson Drill.**

Chamfer both edges of crank hole—**1-Spindle Leland-Gifford Drill.**

Finish grind both sides of crank pin boss and one side of pin boss—**16-A-2 Blanchard Surface Grinder.**

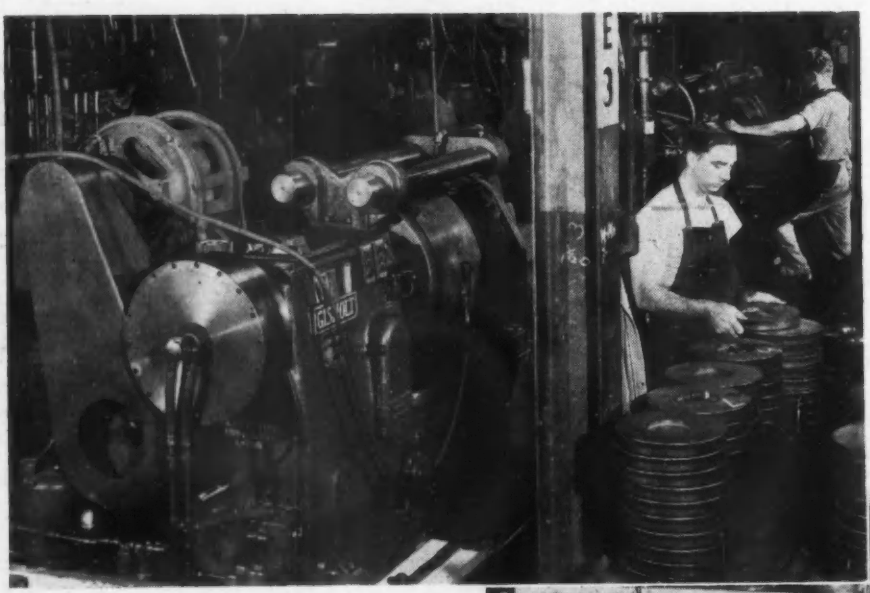
Rough and finish bore piston pin and crankshaft holes—**8-Spindle Heald Boring Machine.**

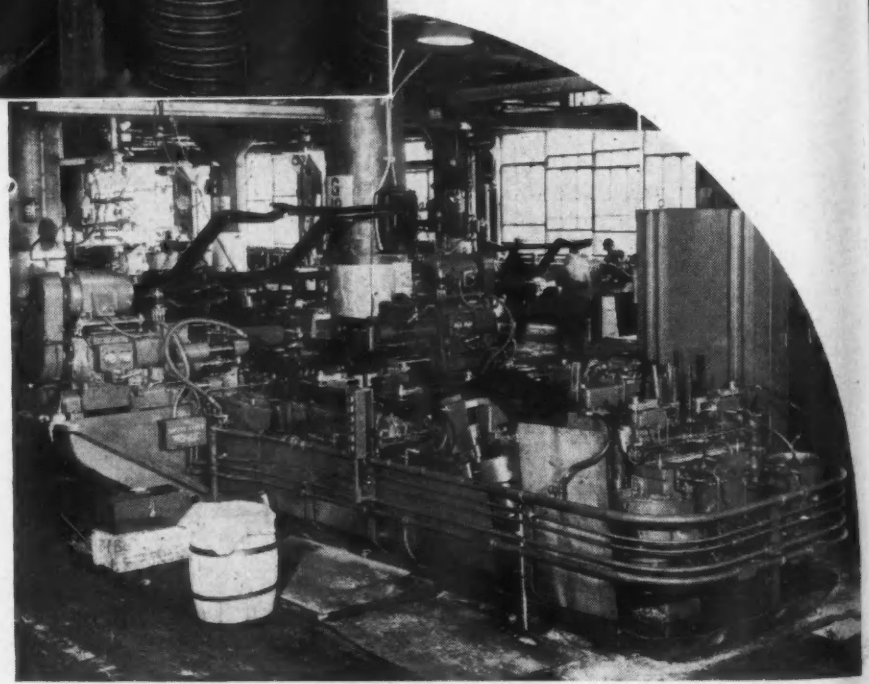
Drill, ream and spotface 1 side of clamp bolt hole—**Greenlee 1-way Vertical Column 4-Station Machine.**

Burr inside pin holes—**Kent Owen Hand Mill.**

Spotface other side of clamp bolt boss and camfer one side of crank hole—**Natco Drill, Special.**

Spotface one side of pin hole to proper dim, 4 at a time—**Studebaker**





(Above) Machining of flywheels has been greatly speeded and quality improved by the use of a battery of Gisholt Simplimatics and Gisholt automatic lathes, the Simulimatic being shown in the foreground.

(Right) Start of chassis assembly at Studebaker—the Commander line is at the left, the Champion on the right. Each line has one of the special Snyder automatic drilling machines, seen in the foreground, for accurate jig drilling of 29 mounting holes in one setting.

Special Drill.
Chamfer one side of crank hole—**No. 2 Single Spindle Leland-Gifford Drill.**
Remove all burrs from bearing locks and crank hole and lap crank end faces—Speed head and bench.
File sharp edges on pin end.
Hone crank pin hole—**Micromatic Hydrohone.**
Chamfer clamp bolt hole and pin hole sides and burr ream clamp bolt and piston pin holes—3 Motor Driven Speed Heads.
Burnish pin holes—**Denison press.**
Punch out oil hole, wash and blow off—Bench and file; Inspect for any defects—Bench; Weigh and hang in rack large end—Bench and scales; Weigh rods and make sets complete rod—Bench and scales; Mark numbers and loosen nuts on caps—Bench; Straighten and hang on conveyor—Bench.

Let us now look at engine assembly procedure for 1947 production. Rods are weighed for big end balance and for overall weight and then are sorted out into stacks of the same weight. For engine assembly, the rods are taken out of the bins in sets of six, matched for the same weight. It is claimed that variation of the total weight of a set of six rods is held within $\frac{1}{8}$ oz by this method of selective assembly. Meanwhile, the cylinder block bores are gaged accurately and each one marked with a code number denoting its diameter. This enables the operators to select a set of six pistons, properly graded for each block.

The set of pistons and the set of rods for each block then go to subassembly while the block is on the line. The rod and piston assembly is completed by installing the pin and rings and returns to the engine assembly line to meet the proper block.

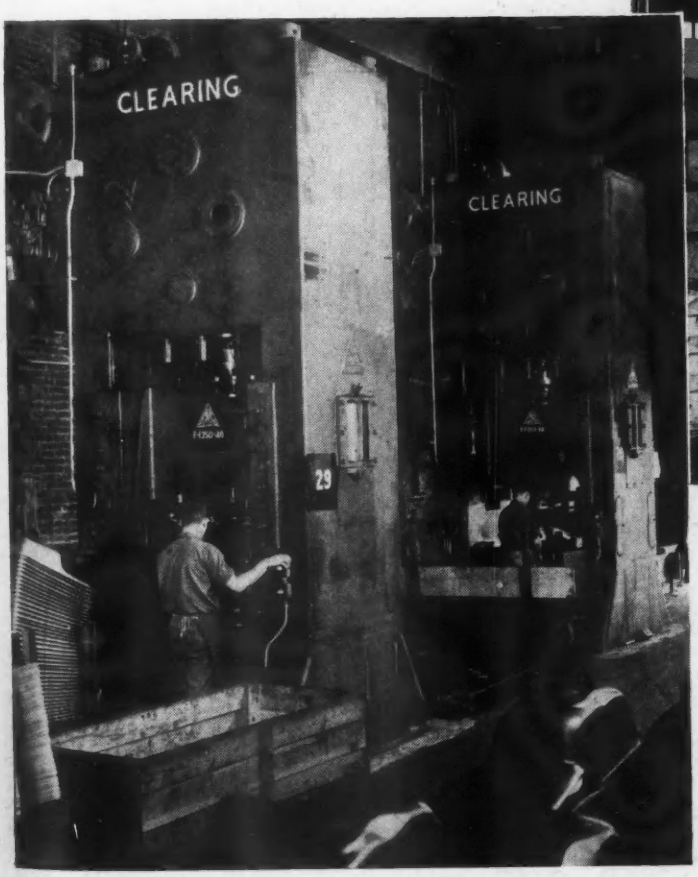
Studebaker makes its own piston pins in an exceptionally modern set-up. The job starts with bar stock in a four-high Conomatic for forming the radius and cut-off. The work then is shaken out, snagged, and pack-carburized. Next operation is cleaning in a Wheelabrator Tumblast cabinet. The carburized pins now go to a battery of $1\frac{5}{8}$ in., eight-spindle Conomatics for drilling and finish taper reaming of one end in one machine, repeating the operation on the other end in a similar machine.

The eight-spindle Conomatics have been completely mechanized for automatic cycling by the use of an inclined magazine feed provided with a mechanically operated push-bar for chucking.

The OD is rough-ground in a Cincinnati plain grinder, a bolt flat is milled in a 1/18 Cincinnati plain automatic mill, then the pins are washed, hardened and drawn, washed, and again Tumblasted.

The final operation consists of rough- and semi-finish grinding of the OD by passing successively through five No. 2 Cincinnati Centerless grinders, using the familiar Danley Feedmatic through feed.

(*Turn to page* 58, *please*)



(Left) View in press shop showing part of the battery of new Clearing presses installed recently.

(Above) Another view in the press shop gives a close-up of one of the latest type Bliss 500-ton presses.

Looking

By Alex Taub

Alex Taub Associates

ALEX TAUB, former Chevrolet engine designer and later chief research engineer at Vauxhall Mootrs Ltd. in England, has prepared for AUTOMOTIVE and AVIATION INDUSTRIES this comprehensive article on his conception of the design trends in future automobile engines. It is being presented in four parts, starting with Part I in this issue. Part I is devoted to a discussion of the utilization of high octane fuels and the layout of a new engine design—a thin type with F-head. The other three parts of the article will follow in early issues and in them he will analyze combustion chamber design, structural and weight considerations, piston and piston ring progress, and the factors in the burning of lean mixtures.

Part One

AUTOMOBILE engines of tomorrow depend on many things, such as, fuel characteristics, fuel availability, car weights, car shapes, and the economics of metallurgy during the next two years. These are the broad pressures. However, no engine trend can go far without the energetic experts, behind the enterprising venders to the industry. Here is a vast source of development that will free engines of the future from their present limitations. Here we will find bearings, pistons, rings, valves, gaskets, ignition, carburetion, and fuel systems.

Effect of New Fuel on Engines

We are certain of improved fuels for the future. We do not know when, nor do we know the extent or nature of the improvement. The most recent reports at the 1946 Summer Meeting of the SAE, although extremely full of needed data, did not deal with all that we must know before we can be sure of the best engine type to utilize the fuels. We are certain, however, that improvements in fuel may include higher octane or higher power per pound of fuel or both. These may be some time in coming, but they are factors which should affect the trend of design now. More understanding of the impurities of fuel is needed in order that we can stabilize our metallurgy and designs. We need to know what effect additives or molecular combinations will have on the leanest mixture that will burn.

For exploiting high octane or sustaining a fortified fuel we must be prepared to deal with higher pressures and rates of pressure rise. High compression ratio, which is the means of utilizing higher octane fuel, increases the maximum pressure and decreases the time for combustion. These two elements compound to give an extremely high roughness probability. Fortified fuel does increase the maximum pressure and so far we have not heard about a compensating increase in combustion time. The integrated result with either fuel will be the excessive bending of the crankshaft and crankcase, with wear on the bearings and structure, and noisy engines.

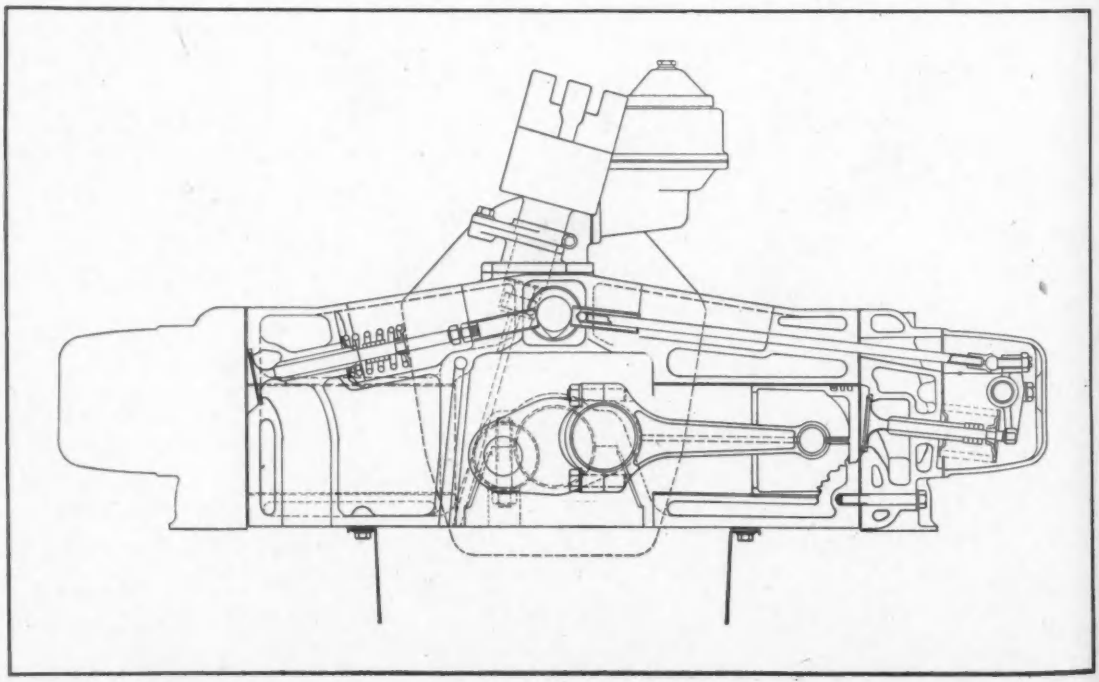


Fig. 1A—Cutaway end view of a proposed F-head, opposed cylinder engine. The space between the cylinder bores is utilized as a position for the exhaust valve.

Forward *to Future Automobile Engines*

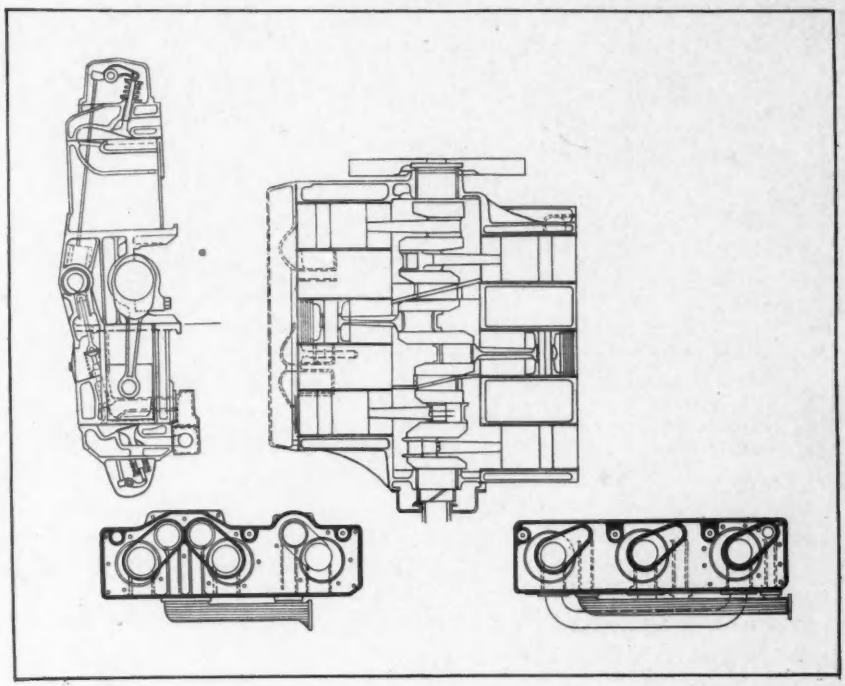


Fig. 1C—Sketches illustrating the "Taub Flat" 180-200 hp 400 cu in., F-head, thin block engine. Notice the location of the exhaust ports.

If this effect is to be offset by structural means, then the cross section through the engine, crankshaft and crankcase must be materially increased in proportion to length. If weight is important then the approach will be through V and pancake engines which decrease the length and increase the cross section. Therefore, we would venture a prediction, that if we are to meet the new fuels of the future we will do better with opposed engines of 4, 6, 8, and 12 cylinders. The rigidity of such engines is also needed to offset the deflections of inherent dynamic forces, some of which help offset combustion roughness while others combine with it to bring about grief.

Many "in-line" engines today deflect dynamically

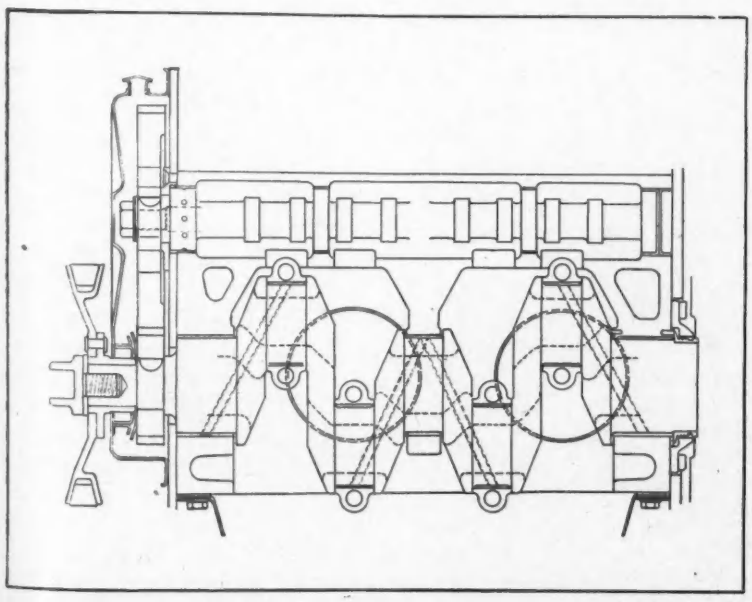


Fig. 1B—Side view at the center of flat, four, opposed cylinder engine with the center line of the crankshaft offset from the centers of the bores. Th crankshaft has no counter weights.

Predictions

of Trends in Future Automobile Engines

1. Shorter engines through opposed cylinders or V's.
2. Improved fuel which may bring on higher maximum pressures and higher rates of pressure rise.
3. Greater rigidity of structures and increased attention to combustion roughness.
4. A "thin" flat engine with F-head which fit in well for rigidity, combustion control, accessibility and good filling ability.
5. Piston weight as an offset to combustion roughness.
6. Strokes shorter than bore diameter.
7. Lower weight class.
8. 40 miles per gallon.
9. Tapered oval pistons.
10. Light weight piston rings with high critical speed for blow-by.
11. Larger intake valve, small exhaust valve, with large hollow stems.
12. Increased use of lighter metals for bodies, gear boxes, and engines.
13. Mixture ratios up to 19.5 to 1.
14. Simplified carburetors.
15. A one-way exhaust system; once past the valve, no return.
16. New spark plugs designed to burn lean mixtures and operate safely at elevated plug temperature rather than engine temperature.
17. Fuel development to improve ignitability at lean mixture. This may result in a real economy fuel.

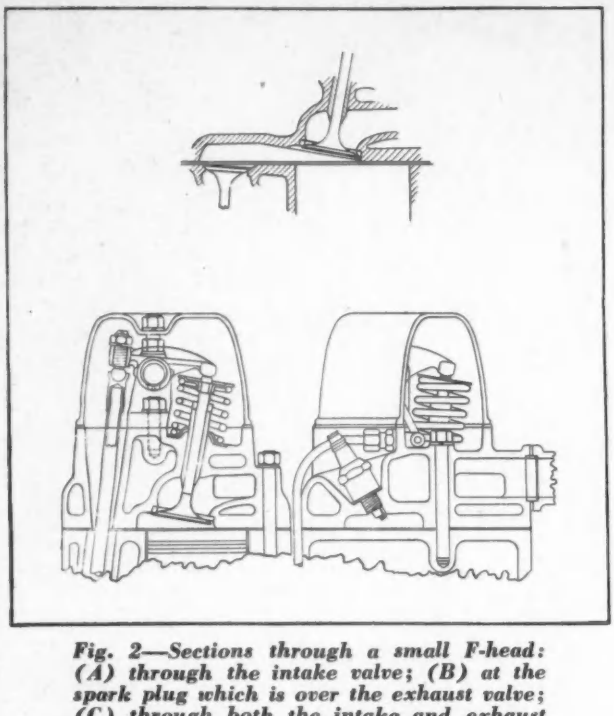


Fig. 2—Sections through a small F-head: (A) through the intake valve; (B) at the spark plug which is over the exhaust valve; (C) through both the intake and exhaust showing their relation.

in the following manner: The ends and top of the engine are relatively still while at the center and bottom the case and barrels swing like a bell.

As a major offset, combustion roughness must be controlled as far as is possible at the source, which is in the combustion chamber. Experience has shown that engines do respond to the following empirical considerations:

The rate of pressure rise is an important factor in combustion roughness and a decelerating rate of pressure rise is required after 25 per cent of the contents of the combustion chamber has been burned. Therefore, a combustion chamber type is required that will lend itself to exploitation, which means that it will give the maximum opportunity for control of volume distribution within the chamber. Much can be done with multiple plugs, and if the pressures are high enough this may be necessary.

Deflection of the shaft and case must be offset. We cannot expect complete results if we think in terms of insulation. Synchronous deflection at the rear of the engine at high speed can exist and does exist in engines given the best possible treatment in the combustion chamber. This is usually measured at the flywheel and can be cured in several ways, which have nothing to do with combustion control:

1. Reduce flywheel weight so that the natural period of flywheel-crankshaft pendulum effect will be out of the operating range.

2. Increase the thickness of rear cheek which incorporates the node so that the natural period will be above operating speeds.

3. Combine one and two.

4. If you cannot decrease flywheel weights or increase thickness of rear crank cheek, then mount the flywheel flexibly or mount it with a bearing front and rear of the flywheel.

When we have removed the flywheel synchronous tossing, we still must relieve the structure of unnecessary punishment due to over-fast pressure rise. It is obvious today and for the future that the best that can be done may not be enough. We must, however, rationalize from our experience in the past in order that we can predetermine our results for the future. When our engines of tomorrow are on the dynamometer we should be certain that insofar as design goes the engine represents our best knowledge. Experimental work from there on will take new courses not now in evidence, and will be based on difficulties created out of new horizons of fuel and performance ambitions.

A New Engine

For structural improvement we offer Figs 1A, 1B and 1C, which show drawings of a thin, flat engine design. It is opposed for any number of cylinders. It is thin, meaning that the engine is only as thick as an overhead valve engine despite the fact that the exhaust valve is in the cylinder block. It has an F-head valve combination wherein the intake valve is in the cylinder head and the exhaust valve in the cylinder block. The space between the cylinder bores is utilized as a position for the exhaust valve. This narrows the thickness or depth of the block and head.

The exhaust ports are inverted and extend toward the bottom of the engine. This permits the intake ports to follow from the head, thus the manifolds are below, reducing the height of the engine due to the height of the manifolds, carburetor and air cleaner. Incidentally, this would make engine adjustments accessible, assuming that the sheet metal surrounding the engine will permit. The clear space at the top would provide a roomy area for disposal of accessories that are normally very crowded.

Rigidity is inherent in an opposed engine and in the design shown in Fig. 1, rigidity is emphasized by the one-piece block and offsetting of the crankshaft center below the cylinder bore centers. Due to the rigidity of construction it lends itself to the use of aluminum. We have had enough experience during the war with aluminum exhaust ports to be willing to step up to this now.

Roughness during combustion is minimized by shape of the combustion chamber which is wide enough to provide for one valve at each end rather than two valves side by side. Anti-detonation is given consideration by locating the spark plug at the exhaust valve, an intake valve at the area where two-thirds of the mixture is burned, and a substantial quench area involving more than 50 per cent of the piston area. Volumetric efficiency or filling ability is improved because we may have a large intake valve located over the cylinder bore.

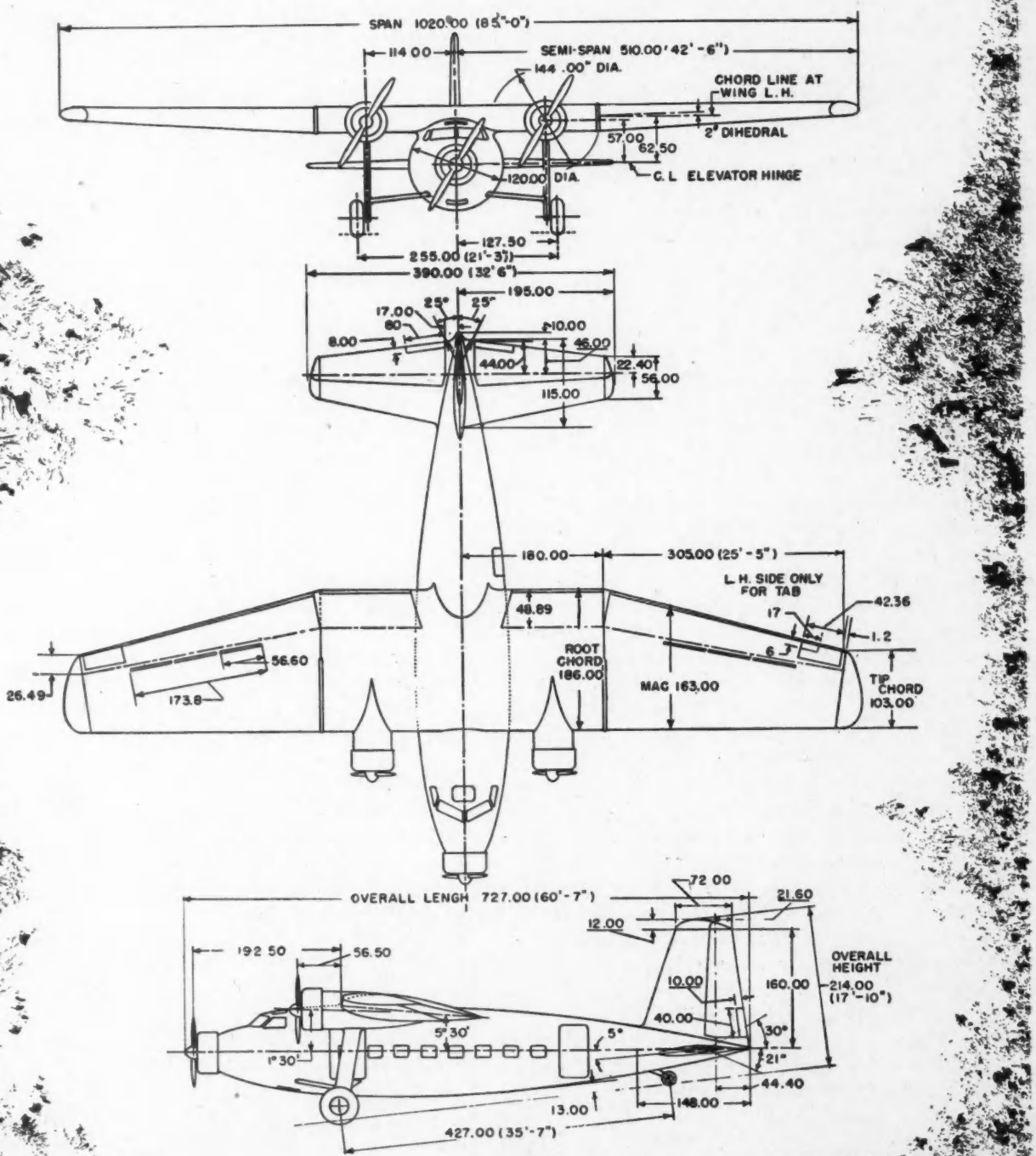
Such an engine has many opportunities. It fits with advantage into designs for modern truck or buses where the ideal position is under the flat platform amidship of the truck. It will fit ideally into passenger cars with front wheel drive permitting the engine to

(*Turn to page 85, please*)

Northrop Pioneer

Cargo-Passenger Aircraft for Short and Medium Haul Operations

Type	All-metal monoplane	Engine Make and Model—	
Gross Weight	25,000 lb		Wright 744C7BA1 800 hp or
Useful Load	10,600 lb		Pratt & Whitney 600 hp S3H1 (R-1340)
Payload (300 miles)	8,500 lb	Fuel Capacity	1,000 gal
Take-off Run (fully loaded)	700 ft	Wing Area	1,100 sq ft
Engines	Three	Landing Gear	Fixed type



Engineering Library

Gas Turbines of the

High Pressure Cycle vs. Low Pressure Cycle Compared by Temperature-Pressure Entropy (Adiabatic)

By John W. Smith

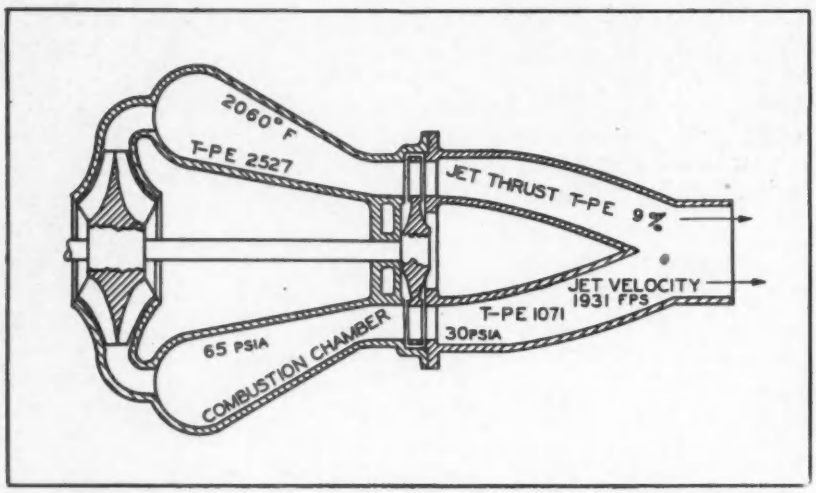


Fig. 1. Outline of conventional low pressure turbojet propulsion engine.

IF THE development of the turbine-jet propulsion engines for aircraft lags in the United States as claimed by British gas turbine experts and also some in this country, by the same token the advance in Great Britain cannot be much farther ahead for in both countries the low pressure type of gas turbine is being continued as the basic principle of design according to the information made available so far. The thermal limitations of the low pressure cycle are well known as are the advantages of the high pressure cycle, and since research in the gas turbine field is veiled by military secrecy, nothing has been announced that would indicate investigation of high pressure cycle is underway and that a mechanism has been developed for successfully utilizing its possibilities.

Evaluation of gas turbine cycles in the following analysis shows why emphasis in research should be placed on high pressure turbine development. It is evident that if America wants to move far ahead of the rest of the world, successful application of the high pressure cycle will make that certain.

Gas turbines so far commercialized for either air or surface propulsion are the low pressure type working at pressures at 60 psi or less. Aircraft turbojet engines operate within this range. The Brown Boveri 2200 hp axial flow gas turbine as used on the Swiss railroad has a working pressure of 50 psi. Working pressure of the U. S. Navy 3500 hp experimental gas turbine is 42 psi. For the low pressure gas turbine cycle attempts have been made to commercialize pressures as high as 115 psi.

For the high pressure gas turbine cycle pressures ranging from 200 to 800 psi have been set in this article with corresponding temperatures of 2400 F to 3700 F absolute.

Fig. 1 is an outline drawing of a representative type commercialized to date for aircraft propulsion, the illustration showing the general arrangement of the centrifugal compressor, combustion chambers, turbine rotor, and propulsion nozzle. A thorough analysis of the major factors affecting the design of an aircraft low pressure gas turbine was given at the SAE 1946 Annual Meeting by William R. Hawthorne, the deputy director in charge of engine research at the

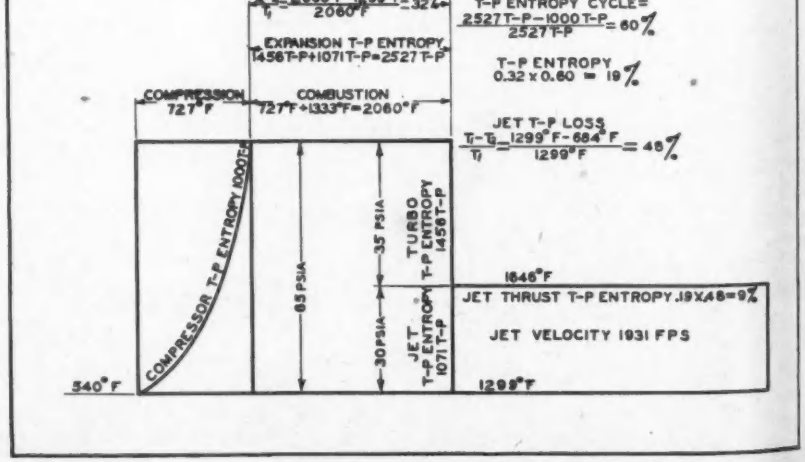

T-T / T = 2060°F-1299°F / 2060°F = 32%
T-P ENTROPY CYCLE = 2527 T-P - 1000 T-P / 2527 T-P = 60%
EXPANSION T-P ENTROPY 1456 T-P + 1071 T-P = 2527 T-P
T-P ENTROPY 0.32 x 0.60 = 19%
COMPRESSION 727°F
COMBUSTION 727°F + 1333°F = 2060°F
JET T-P LOSS T-T / T = 1299°F - 664°F / 1299°F = 48%
COMPRESSOR T-P ENTROPY 1000 T-P
65 PSIA
35 PSIA
TURBO T-P ENTROPY 1456 T-P
1646°F
JET THRUST T-P ENTROPY 1.9 X 48 = 9%
JET VELOCITY 1931 FPS
30 PSIA
JET T-P ENTROPY 1071 T-P
540°F
1298°F

Fig. 2. T-P entropy chart for low pressure turbojet propulsion cycle.

Future

Comparative Engine Thermal Ratings Based on Delivered T-P Entropy

Engine Cycle	Delivered T-P Entropy
Low Pressure Turbine-Jet Propulsion.....	9%
High Pressure Piston Engine	19%
High Pressure Piston Engine with Blowdown to Turbine	25%
High Pressure Turbine-Jet Propulsion....	37%
High Pressure Piston Engine and High Pressure Turbine	45%

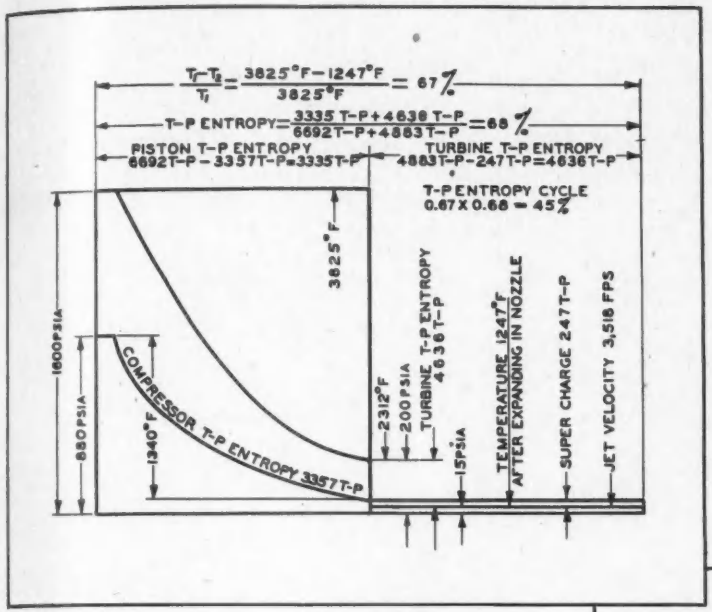
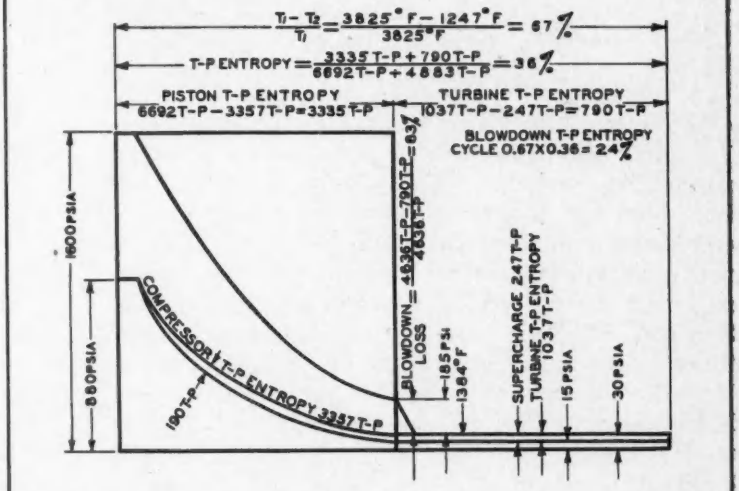


Fig. 3A. (Left) T-P entropy chart for high pressure piston engine and high pressure turbine cycle.

Fig. 3B (Below) T-P entropy chart for high pressure piston engine with blowdown to turbine.



British Ministry of Aircraft Production.

The Temperature-Pressure Entropy in the maps of Figs. 2, 3A and 3B compare the operating cycle of existing low pressure turbines with the cycle of a high pressure gas turbine. Thermodynamicists have applied entropy as an expression for the quantity of heat only. To make an application of entropy for comparing the quantity of energy, pressure and temperature must be included in a suitable adiabatic formula. The Temperature-Pressure Entropy formula as used here for expansion or compression is as follows:

$$T\text{-}P \text{ Entropy} = T_2 \frac{n}{n-1}\left[\left(\frac{P_1}{P_2}\right)^{\frac{n-1}{n}} - 1\right]$$

T_2 = Final temperature, absolute
P_1 = Initial pressure, absolute
P_2 = Final pressure, absolute
n = Ratio of specific heats

All temperatures given on the charts are in the Fahrenheit absolute scale; pressures are indicated whether gage or absolute.

Fig. 2 presents the analysis of the low pressure cycle engine of Fig. 1, in which the T-P entropy cycle is reduced to 60 per cent by subtracting the compression T-P entropy. The T-P value must conform to the

(*Turn to page 67, please*)

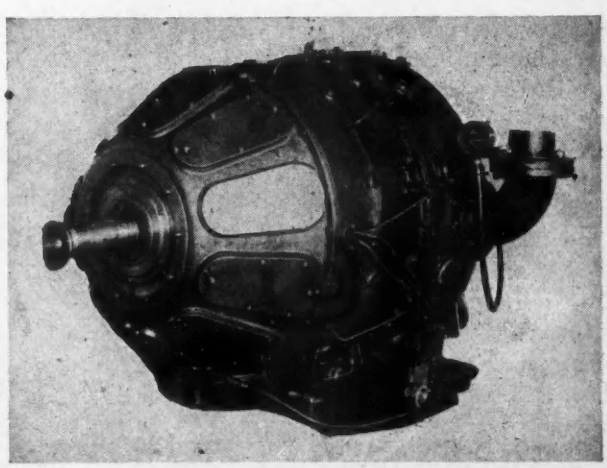


Fig. 4 High pressure turbine with two-stroke, opposed-piston, fuel injection Diesel engine between the compressor and turbine.

TABLE 1

Condition of Motor Vehicles in The Netherlands *(December, 1945)*

Condition	Motor-cycles	Passenger Cars	Motor Busses	Trucks	Special Cars	Tractors	Carriers	Trailers	Total
Unknown	616	579	8	337	17	13	25	59	1,654
New or as good as new	6,367	1,841	186	8,778	210	195	314	505	18,396
Totally overhauled, at least fit for immediate use	35,537	27,788	1,301	13,601	1,831	1,089	1,344	2,327	84,818
Less serviceable; many repairs necessary	19,870	16,429	631	9,341	694	602	265	471	48,303
Only good for scrap	633	732	32	521	39	26	10	14	2,007
Good cars with essential parts missing	210	148	19	105	8	12	35	39	576
Total	63,233	47,517	2,177	32,683	2,799	1,937	1,993	3,415	155,754

What the War

At the time of the liberation of Holland in 1945, surface transportation conditions were most lamentable. They were worse in regard to the railways, 76 per cent of the railway bridges having been blown up, 62 per cent of the total railway network destroyed or broken up by the occupying Germans, and 96 per cent of the total seating capacity lost owing to the cars being taken away to Germany. Even now, after the lapse of over a year, there are still only 26 per cent of the 1939 total of seats available. The streamlined electric and Diesel-powered electric train sections disappeared completely to Germany, 84 per cent of the engines were removed or destroyed, and now only 37 per cent of the prewar total are running.

Owing to the lack of railway transportation, the motor vehicle stock, or rather the pitiful remains of same, was considerably overburdened. Anything on wheels that could be driven was pressed into service. Although in a lesser way, the motor vehicle stock, when compared with the railway rolling stock, shows also too plainly traces of the Germans' domination. New or good conditioned cars were scarcely to be found, the larger part of all passenger cars and trucks having been converted to the use of pressure gas and wood vapor gas fuel. It is not easy to form an adequate picture of the Netherlands' motor vehicle stock at the time of the liberation, for there was no registration of it at the time. Only for the month of December, 1945, are figures known, and these are summarized in Table I.

Of the passenger cars, of which not more than 100 have been imported since May, 1945, there are about 30,000 more or less usable, or 30 per cent of the 1939 number. In December, 1945, once more 65 per cent of the prewar total of trucks were roadworthy, but included therein are nearly 15,000 imported ex-Army vehicles.

Motorcycles were imported to the total of 4500. In May, 1945, there were certainly not more than 10,000 trucks and 200 truck-tractors really usable. Many passenger cars had been rebuilt into trucks and even truck-tractors, sometimes even without modified or adapted transmissions. The only time that writing off could be done during the war was when the vehicle had become totally

TABLE 2

Number of Passenger Cars By Model Years Having More than 1000 Cars

Year	Passenger Cars	Year	Passenger Cars
1930	1,022	1935	4,826
1931	1,597	1936	6,027
1932	1,943	1937	6,978
1933	2,990	1938	6,636
1934	4,336	1939	6,134
		1940	2,159

unfit for service. The average life, therefore, has been more than doubled, and can be safely assessed at the least, at 10 years.

But the greatest proof of the necessity to use anything that could be driven is shown by the fact that in Holland there are still motor vehicles in service dating from the years 1902, 1904, 1906, etc. These are not many of course. Above the 100 is only reached in 1928, with 285 units. Those cars, therefore, are 18 years old. The figures above the 1000 are shown in Table 2.

For the trucks and tractors, the following is valid.

Age of Vehicle	Trucks	Tractors
Up to 5 years	8292	230
5 up to 10 years	10557	818
10 up to 15 years	9629	639
15 years and older	3543	213

Did

to Motor Vehicle Stocks in the Netherlands

By J. P. Kastelein*
Hilversum, Netherlands

* Associate of one of the members of the Association of Export Advertising Agencies.

TABLE 3

Makes of Passenger Cars Registered in 1946 with More than 1000 Cars

Make	Passenger Cars	Make	Passenger Cars
Ford	8,812	Fiat	2,386
Chevrolet	8,288	Citroen	2,029
Opel	5,500	Plymouth	1,226
DKW	3,920	Renault	1,175

In 1939, 13.1 per cent of the trucks were more than 10 years old, and now 41.2 per cent.

The distribution of the various makes is very interesting. Among the older cars, we find some that no longer are being manufactured, such as: Apperson, Case, King, Elcar, Moon, Patterson, Jordan, Beacon (59 units), Locomobile, Liberty, Maxwell, Briscoe, Kissel, etc., and many European makes which have long disappeared. Nearly all have been rebuilt into trucks. The makes represented by more than 1000 units are given in Table 3.

For trucks and tractors in 1946, among which the postwar imports have been included, Table 4 will be found useful for comparison with 1939.

It is plain that there has been a sizeable gain by the various army cars such as GMC, Dodge, Bedford, Austin and Morris in the present-day stocks. The increase in the number of Opel and DKW trucks is attributed to the rebuilding of passenger cars into that type.

The conclusion, therefore, is that of the small number that is left over of the once so modern and up-to-date Dutch car stock, one-third requires the most

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TABLE 4

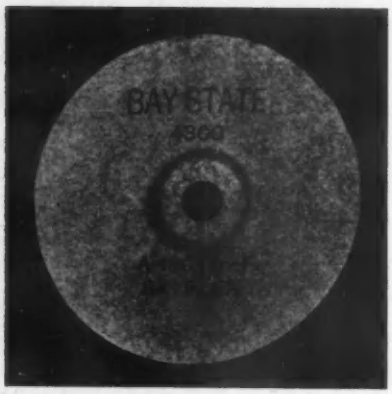
Trucks and Tractors in The Netherlands, 1946 and 1939

MAKE	1946 Trucks Total	1946 Trucks %	1946 Tractors Total	1946 Tractors %	1946 Total Total	1946 Total %	1939 Total	1939 %
Ford	9,172	20.1	404	20.8	9,576	27.7	19,464	35.9
Chevrolet	6,126	18.8	312	16.1	6,438	18.6	15,978	29.5
Dodge	2,462	7.5	55	2.8	2,517	7.3	1,475	2.7
GMC	1,991	6.1	44	2.3	2,035	5.9	276	0.5
Bedford	1,841	5.6	126	6.5	1,967	5.7	670	1.2
Opel	1,577	4.8	52	2.7	1,629	4.7	1,554	2.9
Fordson	1,144	3.5	74	3.8	1,218	3.5	1,914	3.5
DKW	779	2.4	.....	.....	779	2.3	528	1.0
Austin	571	1.7	.....	.....	571	1.6	107	0.2
International	492	1.5	91	5.3	583	1.7	952	1.8

New Products

Raised Hub Disk Wheels

Bayflex raised hub disk wheels, made by Bay State Abrasive Products Co., Westboro, Mass., represent a new type of abrasive wheels. They have a wide-spread application, especially in the field of welded or brazed metals and in grinding aluminum castings. Among their advantages is the fact that the edge can be used for grinding and even cutting off.



Bayflex disk wheel

Bayflex disks can be used efficiently right down to the nut. Under normal circumstances these wheels are not subject to "loading." On the occasions when lead or paint might tend to "load" the wheel, it can be cleaned quickly by touching the face on a concrete floor.

These wheels will fit any standard machine formerly employing coated disks, and are available in the same grit sizes.

Du Pont Synthetic Adhesive Resists Oxidation

A new synthetic, waterproof adhesive more resistant to oxidation than similar natural rubber compounds has been developed by the Du Pont Fabrics Division. The new cement is recommended by the maker for bonding Buna-N type synthetic rubbers and vinyl films or sheet stocks to rigid surfaces such as steel, aluminum, glass, wood, or concrete.

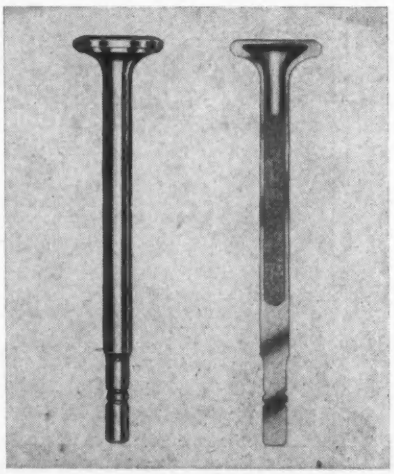
Designated as No. 5118 "Fairprene" adhesive cement, the new adhesive is a thermoplastic synthetic elastic composition that does not require vulcanization to obtain maximum adhesive strength. Oils or straight gasoline will weaken the bond strength only slightly, although aromatic hydrocarbons will destroy the bond. Unaffected by temperatures as low as 40F., the new cement's adhesive strength is weakened at temperature of 160F. and above. Full bond strength is regained, however, after cooling to normal temperatures.

Cold-setting, the new adhesive will dry to a tacky surface, under average conditions, in three to 10 minutes, and dry completely within two hours.

Sodium Cooled Valve for Heavy Duty Engines

An improved sodium-cooled exhaust valve for heavy duty automotive, marine and industrial engines has been brought out by Thompson Products, Inc., Cleveland. The new feature of the valve is that its head is fully hollow, like that of the latest type aircraft valves, in addition to the hollow stem. It is claimed that this greatly increases the cooling efficiency of the metallic sodium, which fills approximately 60 per cent of the valve cavity.

As the valve operates the liquefied sodium splashes the inner surfaces of the head, rapidly draining the heat into the valve stem, where it is dissipated to cooler parts of the engine. This permits higher compression ratios and greatly lengthens the service life of the valve, according to Thompson Products.



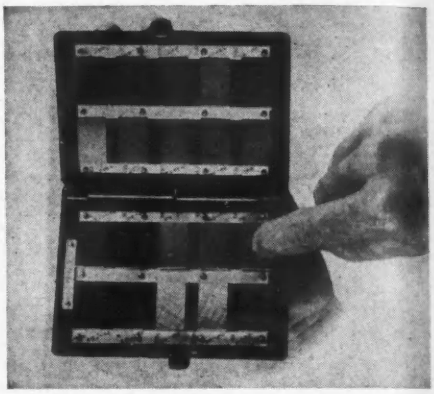
Thompson sodium-cooled valve cross-sectional view shows the full-hollow head

Surface Finish Standards

Conforming to the "preferred-number" series which the American Standards Association has recently adopted for designation of surface finish, a pocket set of standards which affords convenient means of checking surface finishes over a wide scale of roughness has been introduced by the University Machine Co. Division of Baird Associates, Cambridge, Mass.

Designated Type 7, the set consists of twenty small blocks of stainless steel, each of which is machined to the surface finish specified for one of the "preferred-number" standards.

The standard surfaces established by A. S. A. and the finishes furnished in the University Type 7 standard are: 2, 4, and 8 microinches polished; 16 and 32 microinches ground (straight and Blanchard); 63 microinches shaped, turned, and ground; 125 microinches shaped, turned, milled, and ground; 250 and 500 microinches shaped, turned, and ground.



University Type 7 surface finish standard set

Heavy Duty Timken DP Brake

The Timken "DP" Dual Primary hydraulic brake is now being manufactured in a new heavy duty series by the Brake Division of The Timken-Detroit Axle Co., 100 Clark St., Detroit 32, Mich. The heavy duty "DP" brake offers all the features of Timken's "DP" brake design. Its operating principle is the same as that of the medium duty series which has been in production for the past two years.

The "DP" Dual Primary heavy duty series brake, while of the same general design as the medium duty series, is of more rugged construction throughout and, in addition, it is fitted with tie bars to provide straddle-mounting for the anchor pins. It is the only hydraulic brake, it is claimed, that has ¾-in. tapered liners and is mounted on an open type steel brake spider to provide low temperature operation. Removable dust shields are available if required.

There is a single point adjustment for each shoe adequate to compensate for wear of the ¾-in. thick liners. Adjustment for proper clearance between brake shoes and brake drum is made by turning the eccentric anchor pins until liners are tight against the drum and

(*Turn to page 54, please*)

Buda Offers New Diesel Line

of Truck, Marine and Industrial Engines with Range of 15 to 300 hp

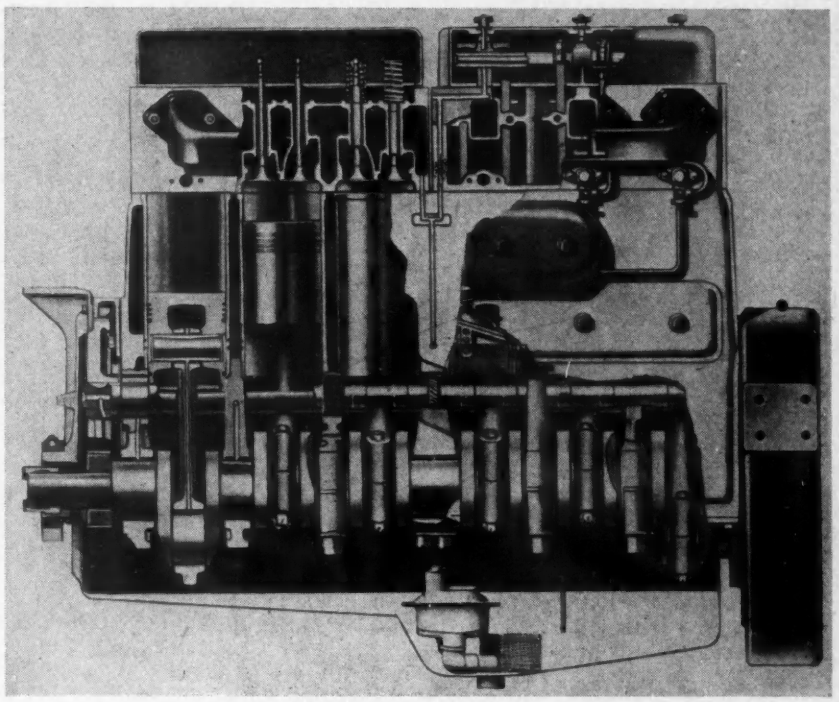
Stemming from its war experience in building Diesel engines for the armed forces, the Buda Company, Harvey, Ill., has announced an impressive program of Diesel engines for motor trucks, industrial applications, and for marine use. In the present move, Buda offers a series of models ranging in capacity from 15 hp to 300 hp, based on standardized design which permits of mass production economies through standardization of basic cylinders and components.

Included in the 161 series are four models—of one, two, three, and four-cylinder type, intended primarily for automotive industrial applications. The two Series 844 six cylinder Diesel engines are designed for motor truck application. The 6-DC-844 is a naturally aspirated engine while the 6-DCS-844 is supercharged to give the maximum rating of 225 hp at 1800 rpm.

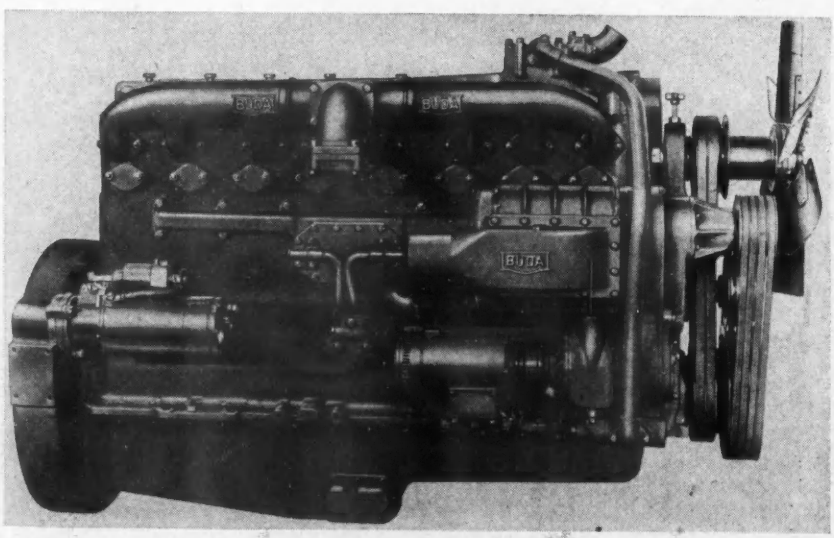
The Series 1125 engines consist of two eight-cylinder models for automotive industrial applications — the 8-DC-1125 which is naturally aspirated and the 8-DCS-1125 which is supercharged to give the top output of 300 hp at 1800 rpm. Both are based upon the standard 5¼ in. by 6½ in. cylinder used in the Series 844. The Borg-Warner supercharger is standard on the 2225 and 844 supercharged engines.

Although the Series 161 line includes bores of 5⅝ in. and 5¼ in. diameter, the 6½ in. stroke is common to all models.

These engines are of four-stroke, full Diesel embodying an adaptation of the well-known Lanova combustion principle. As employed by Buda, this is termed the "Slow-Pressure Combustion System" featuring controlled low pressure at the various stages of the cycle. The American Bosch fuel injection system is standard on all engines.



Sectional view of the Buda Diesel 6-DC-844



Side view of the supercharge 8-DCS-1125

Some general features common to all engines in the 161 Series are as follows: Valve-in-head design; centrifugal water pump, flang-mounted on timing gear case; one-piece alloy iron cast crankcase and cylinder block; heat treated alloy cast iron cylinder heads; aluminum alloy pistons; replaceable exhaust valve seat inserts; chrome nickel steel inlet valves; austenitic steel head exhaust valves with silchrome steel stem; heat treated steel connecting rods with I-beam sections drilled for pressure lubrication of piston pin; removable west sleeve type cylinder liners; special open hearth steel forged, Tocco hardened crankshaft.

Coming to the specific details of the Model 6-DC-844 engine, for motor truck installation, the following basic data are offered: Six cylinder, overhead valve type, 5¼ in. bore by 6½ in. stroke, 844 cu-in. displacement, rated 180 brake hp maximum at 1800 rpm. Maximum torque is 600 lb-ft at 1100 rpm. Electrical equipment consists of a 24-volt automotive type

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New Production and Plant Equipment

Automatic Transportation Company's clamp truck.

AN INDUSTRIAL TRUCK that will handle light and bulky cartons as unit loads without pallet or skid has been designed by Automatic Transportation Co., 149 W. 87th Street, Chicago 20.

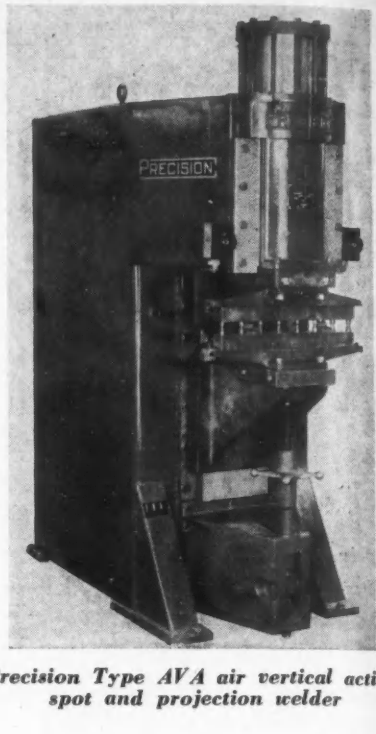
The unit is shown handling a typical load—27 cartons of light bulbs. It is adaptable to any light, bulky cartoned materials.

A specially modified version of standard Automatic fork truck, the "clamp truck" operates with hydraulic "pincers" replacing the regular forks. It is constructed so as to be adjustable to handle any size or type of cartons of light and bulky commodities.

In addition to holding even the bulkiest loads stable, the truck eliminates the need for pallets in tiering, dctiering and hauling operations. The clamping pads, adjustable in height, are mounted on a scissors-like frame opened by a hydraulic pump. Release of the hydraulic pressure allows the springs to pull the clamps together, grasping the load between them.

PRECISION WELDER AND MACHINE CO., 138 E. McMicken Ave., Cincinnati 10, Ohio, has placed on the market a new series of air vertical action spot and projection welders, Type AVA. These press type welders are made in four standard sizes covering the range from 30 kva to 500 kva and pressure to a maximum of 18,000 lb. Among their features are: Honed brass air cylinders with cushion and universal connection to ram; fabricated steel frame, sides plain and unobstructed with overhang arm integral for accuracy and rigidity; and extra long ram with "V" ways fully contained in gibs and shrouded at top from dirt.

Gibs are adjustable for wear and are provided with full-length lubrication. The vertical screw support is used also for knee adjustment by fulcruming to rear. Removal of the solenoid valve from the air terminal unit is accomplished without disconnecting piping.



Precision Type AVA air vertical action spot and projection welder

THE SUNDSTRAND MACHINE TOOL CO., Rockford, Ill., has designed and built a new small duplex type Rigidmil of the No. 0 size. This new Rigidmil is said to offer many possibilities for reducing machining time by milling two surfaces simultaneously on opposite ends of small work pieces and taking light cuts on larger work pieces. The machine has two horizontal opposed spindle heads which have independent vertical adjustment from two in. minimum to 13 in. maximum from top of table to center line of spindle. Thus, cuts on opposite

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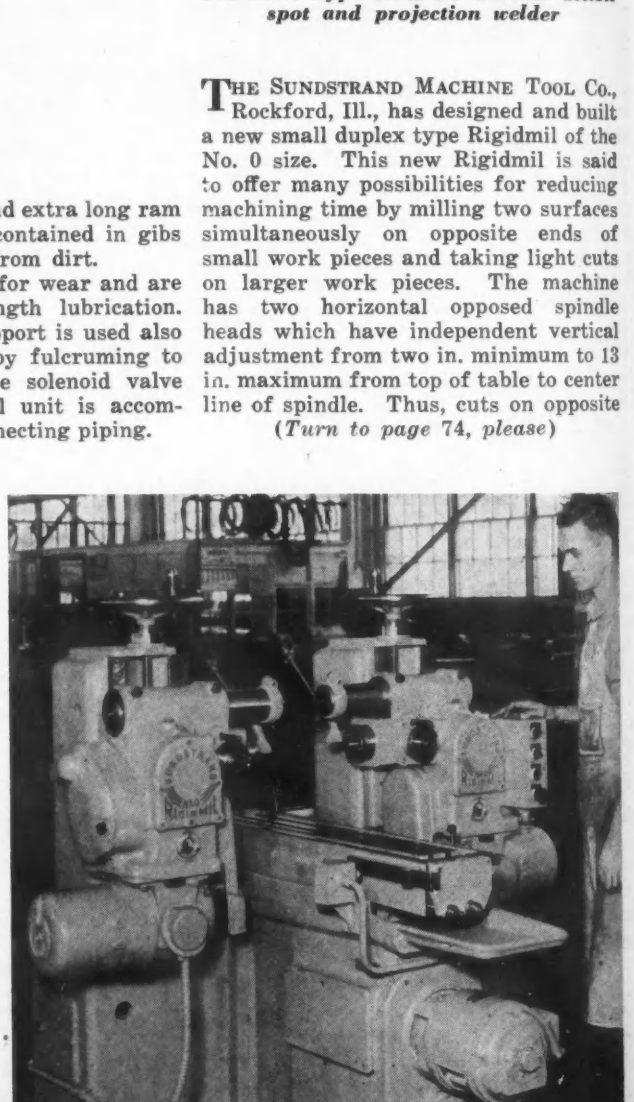


Sundstrand duplex type Rigidmil

NEWS *of the* Industry

Abandonment of Price Controls Expected to Influence Wage Negotiations at Chrysler Corporation . . . Other Automobile Manufacturers to Face Wage Drive Soon . . . No Material Gain in Production Expected During Balance of 1946 . . . Production Rate Still Threatened by Lead Shortage . . . Costly Emergency Measures Keep Lines Going . . . Immediate Decontrol of Automotive Products Not Expected.

The abandonment of price controls on most cost of living items, with the exception of rents, together with virtual relaxation of wage controls, is expected to exert a significant influence on wage negotiations now under consideration at Chrysler Corporation. Living costs have advanced over the past several months since the last wage increase and are expected to continue to climb moderately in the months ahead. That fact is to be the base for the union's demands for a "cost of living bonus."

Just how much the union is to ask for in specific terms has not been disclosed but the general thinking in Detroit is that it will amount to between 20 and 25 cents an hour. Several interesting parallels to the original demands made on General Motors last year are evident in statements by Walter Reuther, president of the UAW-CIO, and union's executive board. Reuther still contends that wages can be increased without a corresponding rise in prices of automobiles. In addition to the wage demands, the union has said it will demand equalization of wage rates to bring sub-standard wages up to industry patterns. Another demand is to be for a social security program, financed entirely by the employer, to provide benefits for workers in case of sickness, disability, or death, and maternity, hospital, surgical, and medical benefits for the worker and his family. While no attempt is made this time to induce the Corporation to take the lead in setting up industry-wide bargaining on wages, a more subtle approach is being taken toward the same end by calling upon management to join with the union in setting up a labor-management committee in the automotive industry to investigate all possible ways to stabilize production with a view to eliminating or minimizing seasonal layoffs in order to establish a guaranteed annual wage. An additional new demand is for a retirement program to supplement present Social Security benefits. However, it is expected that since the contract provided only for reopening the wage question at Chrysler, the extra demands have little chance for consideration and are merely window dressing.

Other Automotive Companies Face Reopening of Wage Issue

While Chrysler is the first automotive manufacturer to feel the brunt of the new wage drive, others will feel it soon. The UAW-CIO executive board has decided to demand substantial wage increases from all employers whose contracts permit. Approximately half the contracts held by the UAW have clauses which permit the reopening of the wage issue on either 30 or 60 days notice. General Motors and Ford, on the other hand, have contracts which run until next April and May, respectively, before the wage clause can be invoked. It is felt certain that management will resist strongly any increase in wages at this time, since to do so would be certain to result in further increase in the price of automobiles, already too high in the opinion of many industry executives. The role of government in the coming wage battles is expected to be of little significance. There is little thought that such impediments as government fact-finding boards and the now infamous Wallace report are likely to be a factor. The way it shapes up to observers in Detroit, is that there will be more of a return to actual collective bargaining than at any time since before the war. Whether or not serious strikes will materialize still is an open question. The union is treading much more softly than it did last Fall and early this year, and it is the general belief that negotiations will be prolonged for a considerable period before a strike actually is called, if at all. The UAW has behind it the bitter experience of the G.M. strike, and its treasury has been sadly depleted since the end of the war, both by loss of membership and by heavy expenditures, including strikes.

Production Not Expected to Gain Materially This Year

In view of the restricted supplies of sheet steel, lead, copper, and other materials, automotive manufacturers are not optimistic about making any appreciable gains over present production levels the rest of this year. Some gloomy predictions are heard in Detroit that some of the factories may close down sometime in November for lack of materials, but this has not found any support as yet among industry spokesmen. They admit that there may be a continuation of temporary stoppages from time to time, as there have been all along, but do not look for any large-scale layoffs over an extended period.

Lead Shortage Continues To Threaten Production Rate

Although the government has increased the amount of lead that may be used for original equipment by 20 per cent, many automotive companies are apprehensive about the battery situation. The shortage appears to be growing worse instead of better, and some manufacturers are considering shipping cars without batteries. One large manufacturer notified its dealers that such might be the case, with the result that those in Detroit began scurrying to round up all available batteries they could buy, thus aggravating the already serious replacement problem. It is estimated that the production of batteries for replacement this year will fall short of original estimates by a million units, which spells trouble in the cold weather months ahead for motorists whose batteries give out.

Emergency Measures Used To Keep Production Going

Fisher Body, faced with hand-to-mouth deliveries of critical body parts, continues to resort to costly emergency measures to keep lines rolling. Normally, parts are shipped by rail freight at a great saving in cost. However, adequate inventories are not possible to maintain at present, so that it is necessary to use air express, rail express, highway trucks, or even chartered airplane. In some cases, rail freight shipments have been intercepted at mid-continent and transferred to some faster carrier in order to reach the destination in time to avert a stoppage of assembly lines. Such measures are expensive and reflect the heavy cost of doing business under current conditions of hand-to-mouth operations.

No Immediate Decontrol Of Automotive Products

Although there is a general rush on by the government to decontrol many commodities, the prevailing opinion is

(*Turn to page 70, please*)

PUBLICATIONS AVAILABLE

Publications listed in this department are obtainable by subscribers through the Editorial Department of AUTOMOTIVE *and* AVIATION INDUSTRIES. In making requests give title above the item concerning the publication desired, the date of issue in which it appeared, your name and address, company connection and title.

Color Conditioning

E. I. du Pont de Nemours & Co., Inc.—32-page booklet duPont Color Conditioning for Industry, illustrated in color, describes the fundamental principles on which color conditioning is based. The Three-Dimensional Seeing treatment of machines is depicted with photographs of actual installations. The Safety Color Code for Industry is also outlined. Color conditioning is shown at work in plants of several well-known companies. A coordinated functional color program for an entire plant is illustrated in a double-page cutaway drawing.

High Frequency Heating & Melting

Ajax Electrothermic Corp.—Bulletin No. 27 describes the principles and advantages of high frequency heating and melting. Included are data to assist in proper selection of equipment.

Resistance Welding Alloys Chart

Ampco Metal, Inc.—New chart entitled Comparative Resistance Welding Alloys lists by groups, classes and trade names, alloys produced by Ampco and several other companies serving the resistance welding field.

Tips to the Foreman

Safety Research Institute, 420 Lexington Avenue, New York 17—Folder entitled How To Use Carbon Tetrachloride Safely, gives information on the proper handling and storage of this solvent and directions for first aid in case of accident.

Drills—How to Sharpen Them

Republic Drill & Tool Co.—Manual G-1, a 24-page booklet outlines the principles of sharpening twist drills. It contains detailed data on the proper care of twist drills and gives a number of pointers on sharpening and web thinning as well as dimensions and angles of proper points for best results in drilling various materials.

Drills—Mechanics Length High Speed

Republic Drill & Tool Co.—4-page illustrated bulletin contains complete information on the new Republic line of mechanics length high speed drills. A Price List is included, together with tables of fractional sizes and wire gage sizes.

Testing Machine

The Baldwin Locomotive Works—Bulletin 205 gives specifications and full details of the company's Sonntag Model SF-10R Rotating Beam Fatigue Testing Machine.

DoAll Education Program

DoAll Co.—Two unique educational pieces are offered by L. A. Wilkie, chairman of the company. A large colorful wall chart used to convey graphically how historical causes and effects are related, shows an arch of progress of which the keystone represented the important place of machine tools as the basis of modern mass production and present high standards of living. Supplementing this chart is a 60-page booklet, "Your Life in the Machine World," which traces the high spots of mechanical and industrial developments.

Aircraft Testing Equipment

Hydraulic Machinery, Inc.—16-page brochure describes Hy-Mac Aircraft Testing Equipment for checking hydraulic mechanism before and after its assembly into aircraft.

Production Tapping Guide

The Cleveland Tapping Machine Co. Booklet includes figures, data and other information designed to assist the estimator, setup man and operator in employing production tapping to the best advantage.

Precision Gages

Sturdy Tool & Gage Co.—Bulletin on new steel, chrome plated, tungsten carbide and Norbide precision gages.

Celfor Tools

Clark Equipment Co.—A 96-page catalog announced by the Celfor Tools Div. of the company gives specifications of the complete Celfor Tool line. It features a 28-page engineering data section, containing much information relating to proper tool selection, how to balance tool capacity with work load and useful maintenance ideas for prolonging tool life.

Industrial Precision Casting

Kerr Mfg. Co.—2 catalogs, Fundamentals of Precision Casting and Precision Casting Equipment and Materials. The first traces the origin of the Lost Wax Method as employed by the Chinese and the modern application of this method to the field of industrial precision casting. The second illustrates and describes the specialized materials and equipment necessary to achieve the close tolerances made necessary by present-day industry for volume production.

Machine Tool Builders Elect New Officers

Herbert H. Pease, president, New Britain-Gridley Machine Division, The New Britain Machine Co., New Britain, Conn., was elected president of the National Machine Tool Builders' Association at the Association's Annual Meeting held at the Chateau Frontenac, Quebec.

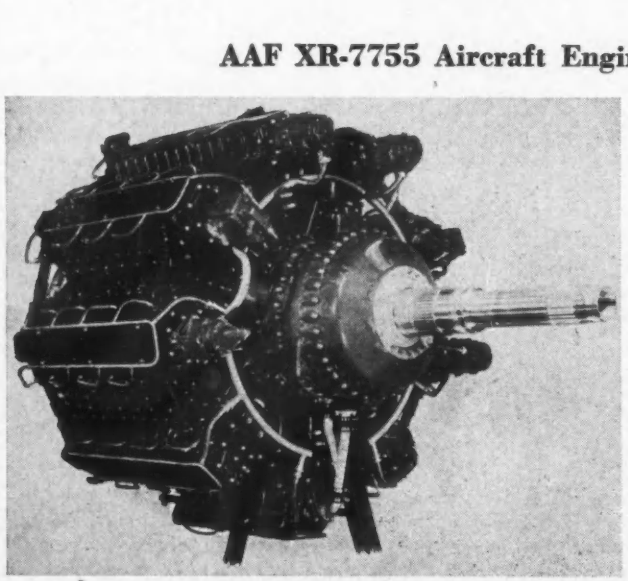
Alexander G. Bryant, Vice-President, Cleereman Machine Tool Co., Chicago, was elected first vice-president, and L. D. McDonald, vice-president, The Warner & Swasey Co., Cleveland, second vice-president. Louis Polk, president, The Sheffield Corp., Dayton, was elected treasurer.

H. L. Tigges, vice-president and Sales manager, Baker Brothers, Inc., Toledo. Mr. McDonald and Mr. Polk were elected directors of the Association. Tell Berna continues as general manager of the Association, and Mrs. Frida F. Selbert as secretary.

Hupp Corporation Acquires Stock of Amgears, Inc.

Hupp Corporation has acquired all capital stock of Amgears, Inc., Chicago, according to a company announcement. The acquisition gives Hupp the plant and properties of the American Gear and Manufacturing Co., also of Chicago, where operations will be consolidated. Amgears will be operated as a subsidiary of Hupp.

AAF XR-7755 Aircraft Engine



The AAF Lycoming model XR-7755 aircraft engine is the most powerful reciprocating aircraft power plant in the world today. It develops 5000 hp at 2600 rpm for take-off and 4000 hp at 2300 rpm for continuous operation. The engine is a 36 cyl., single-crankshaft, liquid-cooled, radial-type with cylinders arranged in four rows of nine each and having a total piston displacement of 7755 cu in.

New Passenger Car Registrations*

July and 7 Months Compared with 1941

Make	July, 1946	January-June, 1946	July, 1941	Seven Months		Per Cent to Total Seven Months	
				1946	1941	1946	1941
Ford	24,893	107,923	65,485	132,816	448,027	19.93	15.69
Plymouth	23,621	74,845	45,758	98,466	350,529	14.78	12.23
Chevrolet	30,805	55,396	95,110	86,201	691,587	12.94	24.22
Dodge	15,872	48,423	21,213	64,295	158,097	9.65	5.54
Nash	8,233	32,824	7,553	41,057	61,596	6.16	2.16
Hudson	7,904	25,581	6,319	33,485	52,150	5.03	1.83
Pontiac	10,543	21,260	28,895	31,803	223,839	4.77	7.84
Chrysler	7,799	23,396	14,874	31,195	109,977	4.68	3.85
Buick	11,866	17,496	33,383	29,362	243,298	4.41	8.52
De Soto	5,813	22,474	9,184	28,287	66,930	4.25	2.34
Oldsmobile	8,647	16,042	24,624	24,689	184,112	3.71	6.45
Studebaker	5,684	15,161	13,051	20,845	80,056	3.13	2.81
Mercury	4,228	16,297	8,704	20,525	61,422	3.08	2.15
Packard	4,679	8,298	5,922	12,977	45,112	1.95	1.58
Cadillac	1,592	5,176	6,970	6,768	46,196	1.02	1.62
Lincoln	652	2,506	1,962	3,158	13,745	.46	.48
Crosley	76	14	121	90	447	.01	.02
All others	54	187	2,658†	241	17,738†	.04	.62
Total	172,961	493,239	391,795	666,230	2,854,858	100.00	100.00

*—Data from R. L. Polk & Co. †—Includes Willys.

SAE National Transportation and Maintenance Meeting Held at Chicago

Air-conditioned motor vehicles with heated walls, fog-proof windows and draftless ventilation, and commercial motor vehicles with bodies of aluminum, magnesium and stainless steel were described before the SAE National Transportation and Maintenance Meeting held in Chicago Oct. 16 and 17.

Lewis A. Rodert, of South Wind Div., Stewart-Warner Corp., Indianapolis, Ind., told members of the Society of Automotive Engineers that it is possible to adapt to passenger cars and commercial vehicles the air-conditioning systems used in transport planes. Mr. Rodert said the use in land vehicles of the aircraft method of circulating air and heat through hollow walls is well within the range of practicability, and asserted that such a system of air circulation would solve the problem of heating and ventilating motor vehicles without causing drafts.

The automotive industry has lagged behind the building trades in the matter of keeping motor vehicle passengers comfortable, and the complaints of patrons of motor buses put a priority on heating, ventilating, and air-conditioning as an immediately essential development, according to E. T. Todd and F. O. Gadd, of the Engineering Div., GMC Truck & Coach Div., General Motors Corp., Detroit, Mich. Explaining that no single solution can be found for the problem of providing for bus passengers the comfortable temperature, complete absence of odors, and good visibility they desire and merit, the speakers presented the results of recent developmental tests to show that heat from the engine, plus use of a booster heater for some installations, can assure proper regulation of temperature, adequate distribution of fresh air, removal of odors, and maintenance of clear windows.

They described the development, for motor coaches, of hot water heating systems which, used in combination with air-circulating fans and thermostats, obtain heat from the engine, and from additional booster heaters in extreme weather. Air is taken in just above the windshield, heated, and discharged from slots above passenger windows on both sides of the coach. Ventilation is facilitated by outlets in the roof. Continuous flow of heated dry air is said to assure adequate ventilation and heating, at the same time preventing the fogging and frosting of windows.

J. H. Dunn, of Aluminum Co. of America, New Kensington, Pa., reported that aluminum bodies for motor trucks assure savings on the order of 10 per cent less fuel consumption, 25 per cent greater tire mileage expectancy, and 10 per cent step-up in acceleration. Magnesium was characterized by Mr. Dunn as eminently suitable for truck bodies, with commensurate savings. Both aluminum and magnesium were said to augment other economies by their resistance to corrosion.

Speakers asserted that trucks with lighter bodies were much more agile on the road and that fewer trucks consequently could perform more work. They explained that light-weight body materials tend to localize unavoidable damage, and actually protect engine and chassis by absorbing shocks.

F. O. Lewis, of Dayton Power & Light Co., Dayton, Ohio, presented an experience record of aluminum-body trucks to show that large increases in miles per gallon of fuel, large decreases in operating costs were possible. Savings in license fees alone, Mr. Lewis said, more than offset the increased costs of aluminum over steel, or wood-and-steel bodies.

Truck bodies of stainless steel were recommended by V. M. Drew, of Fruehauf Trailer Co., Detroit, Mich., as helpful in converting dead weight into revenue-producing payload and in minimizing maintenance and frequency of replacement.

The 100,000-mile tire already is available, the meeting was told by Ben Sorci, of Sorci & Bryant, Chicago, Ill. Mr. Sorci explained that failures to obtain greater mileage from commercial vehicle tires may be ascribed directly to ineffective tire maintenance. Under present methods of operating, Mr. Sorci asserted, the average owner gets no more than 50 per cent of the mileage actually built into his tires.

Shipments of Complete Aircraft and Other Products of Aircraft Plants* In Units and Their Value

PRODUCT	First Six Months	July	August	Eight Months
Complete Aircraft				
For U. S. Military				
Number of Planes	606	64	107	777
Value	$99,276,959	$10,314,559	$9,738,385	$119,329,903
For other than Military				
Number of Planes	13,311	3,388	4,683	21,382
Value	$96,159,496	$10,541,325	$12,665,117	$119,365,938
Total—Planes	13,917	3,452	4,790	22,159
Total—Value	$195,436,455	$20,855,884	$22,403,502	$238,695,841
Conversions				
Number of Planes	145	45	45	235
Value	$18,828,852	$4,700,622	$5,879,157	$29,408,631
Airframe Spare Parts				
For U. S. Military—Value	$16,830,443	$2,258,263	$1,733,670	$20,822,376
For other than Military—Value	$8,258,215	$1,318,371	$1,515,815	$11,092,401
Total—Parts Value	$25,088,658	$3,576,634	$3,249,485	$31,914,777
All Other Products				
Modifications—Value	$5,511,258‡	$394,403	$166,140	$6,071,801
Aircraft Products—Value	$2,037,999†	$1,399,519	$580,443	$4,017,961
Non-aircraft Products—Value	$9,950,826	$2,275,566	$2,471,820	$14,698,212

*—Industry Division—Bureau of the Census.
‡—Includes Aircraft Products for first 4 months.
†—For months of May and June only.

First Postwar National Production Meeting of the SAE Held in Cleveland

"The effect of the Alice-in-Wonderland theory of government and of organized labor leaders that wages can go up and productivity can go down at one and the same time," asserted Charles J. Stilwell, president of Warner & Swasey Co., and principal speaker at the SAE National Production Meeting banquet in Cleveland, "has been to hold down the supply of goods and services and consequently force prices up, thereby defeating the benefits of wage increases one after another."

The SAE National Production Meeting held on Oct. 14, 1946, which marked the first special program of the Production Activity since 1940, featured three technical papers and the banquet session.

In presenting his thesis "The Much-Discussed Production," Charles J. Stilwell went on to say that "the way to get volume production, and the only way, is to keep costs low in relation to income." But productivity is not the responsibility of management alone. According to Stilwell, it is likewise the major responsibility of the worker. Productivity cannot be achieved without the maximum of cooperation of both. "And it is this cooperation, which today is being undermined and in many cases destroyed" emphasized the speaker, "which should cause us more serious concern than any other single problem connected with production."

"Stated just as tersely as I know how," Mr. Stilwell said, "if all the people are to have more of the things of life, if they are to enjoy a richer, fuller existence, then more things must be produced each working hour by every worker."

The first technical session, with past-vice-president, J. E. Hacker as chairman, was devoted to "What's the Matter with Cast Iron," by A. A. Weidman, Detroit Diesel Engine Div., General Motors Corp., which touched on the foundry problems that beset all manufacturers. Dealing with some 80 foundry sources, and being familiar with their problems and performance, the author urged better cooperation among the people concerned—the user, the designer, the inspector, the purchasing agent, and the foundry management.

The afternoon session, under the chairmanship of Joseph Geschelin, past vice-president, included two outstanding papers—one a research report on grinding; the other, an important outline of the development of industrial engineering in controlling plant operations.

"The Removal of Metal by Grinding," by R. E. McKee, R. S. Moore, and Prof. O. W. Boston, is the first of a series of research studies to be issued by the Department of Metal Processing of the University of Michigan. It describes a new technique for evaluating the effectiveness of grinding compounds and grinding wheels in relation to the material being ground. The wear of the wheel, metal removed, net power, and surface finish of the work are measured by a standardized test procedure.

The paper "Management Control Through Industrial Engineering," by E. F. Gibian, chief industrial engineer, Thompson Products, Inc., is a definite contribution to management literature, providing a comprehensive view of an integrated industrial engineering program for exercising managment control over all phases of plant operation. Describing the system developed at Thompson Products, the paper covers all functions of the industrial engineering group and sets up the principles for the preparation of all classes of standards as well as their final use in a variable budgetary control.

The steps in introducing and operating the daily budgetary control system are described in detail and illustrated by actual examples. Functions of manpower control, plant layout and methods, cost engineering, production control, statistics, incentives, and other activities are described.

The system is distinguished by the integration of all functions of industrial engineering under a single directing head, reporting to the top management, and consulting with all departmental heads. One of its outstanding features is that of providing the foreman with a daily budgetary report which enables him to look over his operation and to correct obvious discrepancies. It has the effect of putting the foreman in business for himself. He is kept informed as to the objectives of his department, of the standards established for all functions within his department, and from that point on he is given the responsibility for running the business.

American Society of Body Engineers Holds First Annual Technical Convention

The American Society of Body Engineers made its formal entry into the ranks of technical organizations when it held its first Annual Technical Convention in Detroit, Oct. 23, 24, 25. Attendance the first day was between 200 and 250 persons and the second and third day meetings also were heavily attended. A total of 18 papers were presented at the eight general sessions which covered styling, production engineering, commercial bodies, vacuum and hydraulic mechanisms used in bodies, passenger car engineering, buses and coaches, choice of materials in body construction, and truck bodies.

M. W. Welty, representing automotive and aviation parts manufacturers association, addressed the convention at an open house the first night of the meeting. He said that one of the most vicious things being done by organized labor is the undermining of the economic system by attacks on "profits." Because government reports will be misused and misinterpreted by union officials, he said, workers will be walking picket lines in the mistaken belief—based on half truths and misinformation—that "the boss is a greedy profiteer." He urged changes in the basic labor laws to insure equality before the law for both employers and unions, re-establishment of fairness, expertness, and integrity in government, education on economic facts to combat "crackpot" theories, and the re-establishment of the belief in fair dealing between various segments of society.

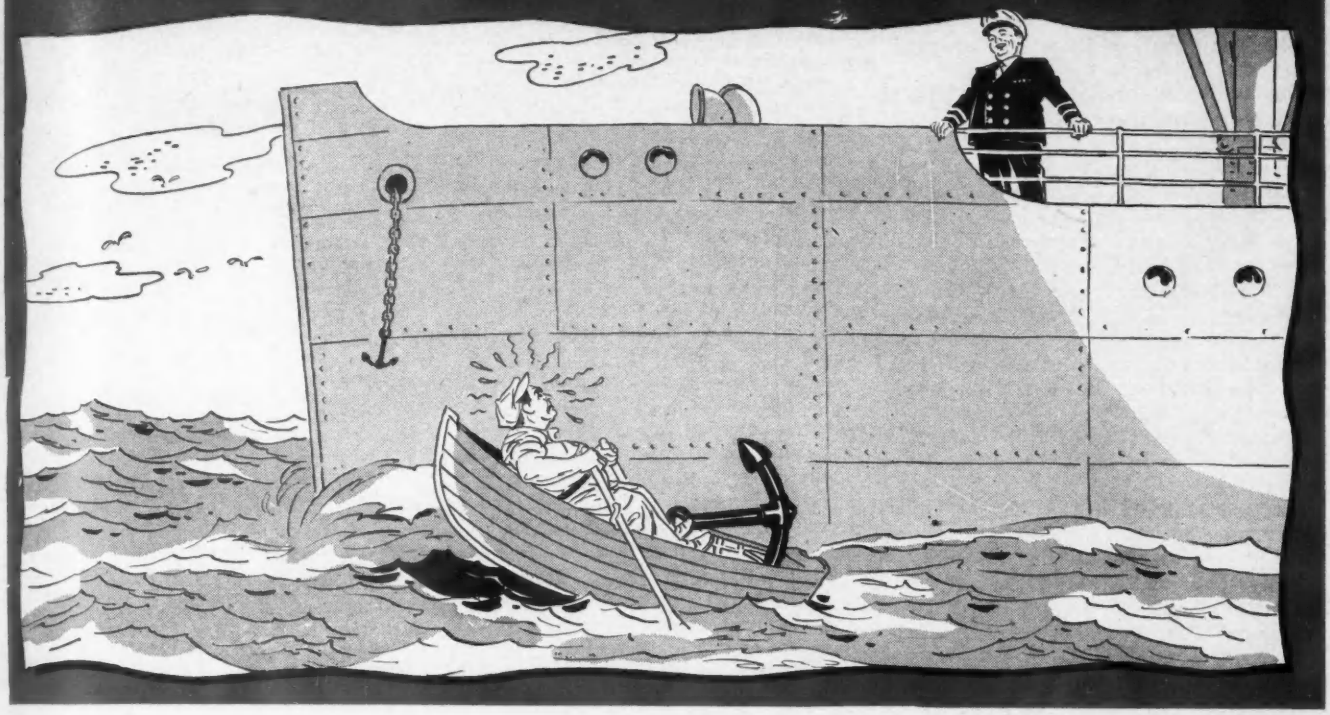
The American Society of Body Engineers today comprises a membership of approximately 160, all bona fide body engineers. To qualify, a candidate must be at least 21, and either a graduate of a school legally authorized to confer a bachelor degree in engineering, or the allied arts and sciences, or who through practical experience has acquired an equivalent technical knowledge, or a person who is regularly engaged in the direction or prosecution of engineering or the allied arts and sciences, as related to body engineering. He further must be a member in good standing of the Engineering Society of Detroit, either resident or non-resident. Although headquarters are in the Rackham Memorial Building at Detroit, activities cover the entire industry. The present membership includes engineers from other cities, such as South Bend, Ind., and Kenosha, Wis.

Present officers are: I. Louis Carron, Dura Div., Detroit Harvester Co., president; Cliff Doty, Briggs Mfg. Co., vice-president; Otto Graebner, Murray Corp., secretary, and Charles Walker, Chrysler Corp., treasurer. Trustees include the officers and Ed Desmet, Willys-Overland; Fred Hall, G. M. Truck and Coach; A. O. Koppin, Hudson Motor; W. R. Milner, Pontiac Div of G.M., and John Votypka, Motor States Products Co.

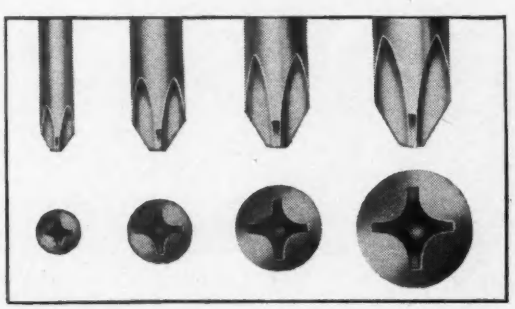
According to literature published by American Society of Body Engineers, "it is not the intention of this society to compete with the Society of Automotive Engineers, the Johnson Alumni, the Desmet Alumni, or similar groups. These organizations fulfill certain needs which this society does not pretend to cover. However, this society will at all times be glad to cooperate with these groups, when to do so will promote the advancement of the profession of body engineering."

An excellent feature of the convention this year was the outstanding industrial exhibits which it attracted. Thirty-six manufacturers of body materials and hardware filled the exhibition room with their products, many of which indicated future design trends.

What's WRONG with this picture?



FOUR SIZES of drivers insure best results with the Engineered PHILLIPS RECESS



Phillips Recesses are designed for maximum driving power in each size of screw. Drivers are matched to insure proper torquing values.

There are only four drivers to cover the complete range of sizes, and two drivers fit 85 per cent of all Phillips Screws used.

With the correct size of driver you get all the advantages of recessed screws and avoid the "bugaboo", present in some recessed screws, of possible reaming. The great driving power of the cruciform recess makes this a real danger when you use too large a driver.

Conversely, too small a driver spoils the outstanding advantage which the recessed screw can give you—that same driving power.

We design delicate tools for the tiny screws and robust, sturdy tools where maximum torques are permissible. It pays to use the right tool for the job.

A ship's anchor is out of place in a rowboat!

National HEADED AND THREADED PRODUCTS

THE NATIONAL SCREW & MFG. CO., CLEVELAND 4, O.

PERSONALS

Recent Personnel Changes and Appointments at the Plants of Automotive and Aviation Manufacturers and Their Suppliers.

Chrysler Corp.—**William C. Flaherty**, Chief Statistician.

The White Motor Co.—**Carl A. Lindblom**, Chief Engineer.

The White Motor Co.—Motor Coach Div.—**A. F. McDougald**, Sales Mgr.

Nash-Kelvinator Corp., Nash Motors Div.—**V. E. Boyd**, Asst. to the General Sales Mgr. **Herman Everhardus**, Asst. Director of Industrial Relations.

Willys-Overland Motors, Inc.—**James J. Welker**, General Mgr., West Coast Plant, Maywood, Calif.

Ford Motor Co., Lincoln-Mercury Div.—**M. R. Blattner**, Head of Business Management Dept.

Graham-Paige Motors Corp.—**Vern E. Van Saw**, Factory Mgr., Farm Equipment Div.

Packard Motor Car Co.—**James McMillan**, elected a director of the company.

Willys-Overland Motors, Inc.—**R. A. Schroeder**, head of planning section, Operations Div.

Mack-International Motor Truck Corp.—**Helmar Peterson**, Factory Mgr., Long Island City Plant. **Jack Henebery**, Mgr. of New Orleans Branch.

Gar Wood Industries, Inc.—**Thomas A. DeMarco**, Executive Asst. to **John J. Bergen**, Chairman of the Board of Directors.

Solar Aircraft Co.—**Harry A. Campbell**, resigned as Director of Research. **Dr. M. A. Williamson**, head of Technical Research Dept., assisted by **Dr. J. A. Southard** in charge of Process Control and **Ralph V. Hilkert**, Chief Metallurgist.

Ryan Aeronautical Co., Metal Products Div.—**Leighton M. Harvey**, Sales Engineer.

United Aircraft Corp.—**James S. Lee**, appointed European representative.

Air Associates, Inc.—**R. B. Kenty**, Vice-President in charge of Domestic Sales.

The Glenn L. Martin Co.—**Henry S. Curtis**, Mgr., new Painesville, Ohio Chemical Plant. **Emilie W. Milan**, Supervisor of Production; **Dr. Wm. J. Lightfoot**, Chief Engineer, Plastics and Chemicals Div.

E. I. duPont de Nemours & Co., Inc.—**Frank P. Smith**, Sales Engineer, Cleveland Region.

United States Rubber Co., Naugatuck Chemical Div.—**George R. Vila**, Sales Mgr. for Latex, Lotol, Rubber Dispersions and Plastic Products.

Ahlberg Bearing Co.—**P. J. Aquilino** and **Henry J. Shuster**, Asst. Mgrs., Washington and Philadelphia branches.

Borg-Warner Corp.—**G. A. Shallberg, Jr.**, Advertising Manager.

The Hydraulic Press Mfg. Co.—**Robert F. Ohmer**, Vice-Pres. in charge of Administration. **Fred C. Ziesenheim**, Sales Mgr. of Plastic and Die Casting Machinery Divs.

Menasco Co.—**D. B. Acker**, Vice-Pres. in charge of Operations and Director of the company.

General Tire & Rubber Co.—**Edward B. Butler**, Director of Public Relations.

SKF Industries, Inc. — **Harry F. Gracey**, Training Director in charge of organizational development program.

Indian Motocycle Co.—**M. J. Fox, Jr.**, elected to Board of Directors and appointed Treasurer.

Allis-Chalmers Mfg. Co.—**James D. Greensward**, Asst. to **Wm. C. Johnson**, Vice-President of the General Machinery Div.

The Yoder Co.—**Wm. J. Kerr**, Vice-Pres. in chg. of Production. **Norbert C. Rubin**, Vice-Pres. in Chg. of Sales.

Perfex Corp.—**Carroll E. Lewis**, Executive Vice-President.

Dayton Rubber Mfg. Co.—**M. H. Clarke**, Vice-Pres. and Director of Manufacturing.

Casco Products Corp.—**Harry H. Friedman**, Asst. Adv. Mgr.

Chandler Industries, Inc.—**Howard I. Doremus**, resigning to establish his own business on West Coast.

Sorensen & Co., Inc.—**Carl W. Muller**, Vice-Pres. and General Mgr.

Illinois Tool Works—**Duncan Stuart Campbell**, has joined staff of field engineers.

The Budd Co.—**Mrs. Wilma Soss**, Public Relations Consultant.

National Electric Welding Machines Co.—**B. L. Wise**, Production Engineer.

CALENDAR

Conventions and Meetings

SAE Natl. Fuels & Lubricants Mtg., Tulsa ..... Nov. 7-8
American Battery Manufacturers Annual Fall Session, Chicago..... Nov. 7-9
Amer. Management Assoc. Production Conference, Chicago ..... Nov. 14-15
Natl. Aircraft Show, Cleveland.. Nov. 15-24
French Aero Show, Grand Palais, Paris Nov. 15-Dec. 1
American Welding Society Annual Meeting, Atlantic City ..... Nov. 17-22
American Assoc. Motor Vehicles Adm. Annual Mtg., San Francisco.. Nov. 18-21
Natl. Metal Congress and Exposition Atlantic City ..... Nov. 18-22
Automobile Old Timers Annual Mtg., New York ..... Nov. 20
SAE Natl. Air Transport Engineering Mtg., Chicago ..... Dec. 2-4
National Wheel, Rim Assoc., Annual Meeting, Chicago ..... Dec. 4-7
Natl. Standard Parts Assoc. Conv., Atlantic City ..... Dec. 6-7
Motor & Equip. Wholesalers Assoc. Convention, Atlantic City ..... Dec. 6
Society for Experimental Stress Analysis, Annual Mtg., New York.. Dec. 9-11
Automotive Service Industries Show, Atlantic City ..... Dec. 9-14
Int. Aviation Celebration & Exhibition, El Paso ..... Dec. 12-15
SAE Annual Mtg. & Eng. Display, Detroit ..... Jan. 6-10
Natl. Assoc. of Eng. & Boat Mfrs. Motor Boat Show, New York City, Jan. 10-18
Natl. Materials Handling Exposition, Cleveland ..... Jan. 14-17
Amer. Soc. for Testing Materials—Spring Mtg., Phila. ..... Feb. 24-28
Nat'l Assoc. Corrosion Engineers National Convention, Chicago... April 7-10

New Buda Diesel Line

(*Continued from page* 45)

starter, using a series-parallel system. Generator is 12-volt, 350-watt capacity, base-mounted and voltage regulated. Air cleaner is of oil bath type. Engine speed is regulated by a fly-ball mechanical governor, with variable speed and manually controlled. It is driven by spiral gear off the fuel pump shaft.

The by-pass type oil filter is located on the site of the crankcase, easily accessible for cleaning and changing. Oil capacity is 24 quarts.

The fuel system incorporates a plunger-type fuel supply pump integral with the fuel injection pump, injection being controlled by a governor built integrally with the pump. Fuel specifications are furnished by Buda but, in general, fuels from 30 deg to 35 deg Baume gravity are acceptable. Injection nozzles are of self-cleaning pintle type, one per cylinder. They are so arranged in the cylinder head as to direct a horizontal spray parallel with the piston dome, so that the fuel spray does not strike pistons or cylinder walls.

The cooling system is handled by a centrifugal water pump mounted on the timing gear case and gear driven at 1.5 times crankshaft speed. Water is pumped directly into the block through a distributor manifold which contains an oil temperature regulator element. Water discharge is through a manifold on top of the engine, housing two thermostatic valves which regulate the flow to the radiator and permit water to be by-passed to the pump during the warm-up period. Cooling water capacity of the engine alone is 9¾ gallons.

The seven-bearing crankshaft is drilled for pressure lubrication to the connecting rod bearings. Main bearings are of steel back, precision type with copper-lead linings. Camshafts are forged and heat treated and mounted on four precision type bronze bearings.

Pistons are of aluminum alloy, 6¾ in. in length, with five rings—three compression and two oil control. Piston pins are full floating, 1¾ in. in diameter.

Inlet valves are of chrome-nickel steel with two-inch clear diameter. Exhaust valves, with 1⅞ in. clear diameter, have an austenitic steel head

VICKERS HYDRAULIC CONTROL means *Greater Productivity and Versatility* FOR ETNA Tube Cutoff Machines

Important advantages of Vickers hydraulic controls that make for higher production rates and greater versatility are illustrated by this Etna Hydraulic Tube Cutoff Machine. Completely automatic is the cycle which feeds the tubing rapidly and accurately to length within a few thousandths, provides quick action clamping, cuts off and then unclamps the stock. Feeding and clamping rates are varied by simply turning a dial . . . there are no cams or gears to change. The rapid traverse approach of tool slides and the rapid return save time. The machine is compact and completely self-contained; it is changed from one diameter of tube to another in a few minutes.

Investigate the resources of Vickers hydraulic controls for your machines . . . talk to a Vickers application engineer.

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Engineers and Builders of Oil Hydraulic Equipment Since 1921

Representative Vickers Hydraulic Control Units used on Etna Tube Cutoff Machine

and Silchrome XB stem. Push rods are made of annealed steel tubing. Tappets are of barrel type with replaceable guides.

The engine is fitted with cylinder liners of removable wet sleeve type, made of alloy cast iron composition. Two cylinder heads of alloy iron, fitted with replaceable exhaust valve inserts, are employed. Intake manifold is of cast iron, provided with an electrical air heating element and connections for air cleaner or silencer. The cast iron exhaust manifold is made in three sections and is available with rear down or top center exhaust outlet. The flywheel is of semi-steel with eight alloy steel bolt fastenings.

Approximate weights for this model are as follows: net weight, 2755 lb.; shipping weight, 3200 lb.; export shipping weight, 3700 lb.

Provision is made for an SAE tachometer drive; also for vacuum pump or an air compressor.

Applicable specifications unique to the Model 8-DC-1125 engine are as follows: other data are the same as for the Series 844; eight-cyl., four-cycle, overhead valve, 5¼ in. bore x 6½ in. stroke, 1125 cu. in. displacement. The nine bearing crankshaft has precision type steel back bearings with copper-lead lining. The camshaft is mounted on six precision type copper-lead bearings.

The cast iron exhaust manifold is available either in three-piece dry type or a one-piece water-cooled type. The cooling system has a capacity of 44½ gal. including the radiator.

This engine can be arranged for three-or four-point suspension and has provision for temperature gages, air compressor or vacuum pump. The oil pan is of one-piece welded steel construction with a band hole on each side; a cast iron pan is also available.

On all models the fuel oil to the injection pump is passed through filters of ample size, accessible for cleaning from the outside.

NEW PRODUCTS

(*Continued from page* 44)

then backing off slightly for running clearance.

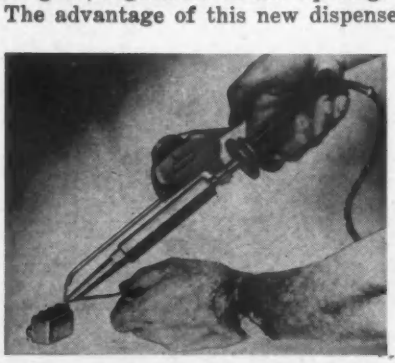
The new "DP" Dual Primary heavy duty series hydraulic brake is now available and also being used on certain Timken truck rear axles and on trailer axles now in production.

Solder Dispenser for Electric Soldering Irons

Sound Equipment Corp., 3903 San Fernando Rd., Glendale 4, Calif., offers a new solder dispenser known as Kwikfeed.

Kwikfeed can be attached to any conventional electric soldering iron by means of an adjustable adapter leaf, and is operated by thumb or finger pressure of the hand holding the iron. It has positive ratchet feed and is constructed of stainless steel. The tube which feeds the solder is adjustble to assure the user that solder will be fed to the exact point where it will do the most good, regardless of the tip length.

The advantage of this new dispenser is in the elimination of holding solder in one hand and iron in the other. The free hand can adjust the work being soldered.



Kwikfeed solder dispenser

Lubricant for Open Gears

A LUBRICANT which is easily brushed or sprayed on open gears is announced by The Texas Co. The new lubricant, called Texaco No. 2-X Fluid, contains a base material which has high adhesiveness, cut back with a non-inflammable solvent. This combination results in a lubricant which is said to be both efficient and easy to apply.

Inkless Tachometer Recorder

A lightweight, inkless tachometer recorder to provide a record of rotating speed has been made available by the Meter and Instrument Division of the General Electric Co., Schenectady, N. Y.

Designated at the Type CF-3, the recorder is designed to operate with an aircraft-type a-c tachometer generator, although any a-c generator with suitable characteristics can be used.

Scale range of the recorded is 0 to 3000. When used in conjunction with aircraft-style tachometer generators, the minimum indicated speed under normal conditions is 600 rpm and the maximum continuous speed is 2500 rpm. Readings are accurate to within 1.5 per cent of full scale with full-scale deflection obtained in two seconds.

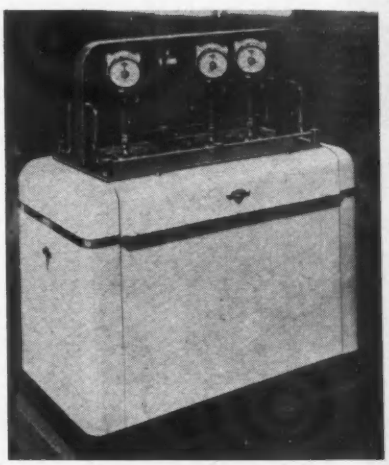
The enclosing case, which is splash-proof and weatherproof, is an aluminum-alloy casting with a pressure gasket getween case and cover. Although furnished in portable form, it can be readily mounted on the surface of a wall or panel.

The record is made on a four-in. wide record roll by means of a typewriter ribbon. The standard chart speed is three in. per hour, and additional rate gears are available for chart speeds on one in. per hour, two in. per hour, or one in. per day. The recorder is of the "inkless" type.

Engine Oil Dispenser

Lincoln Lubreels, a recent development of Lincoln Engineering Co., 5701 Natural Bridge Ave., St. Louis, Mo., provide the newest method of dispensing engine oil direct from 55-gallon original refinery containers to the crankcase without the use of measures, funnels or can openers.

In Lubreel installations, pumps and containers are placed in out-of-sight or remote locations, and oil is piped direct to the Lubreel which can be placed at any convenient location. All hose assemblies are mounted on individual, air-operated, automatic retracting reels. Each control valve is equipped with a totalizing meter which registers the amount of oil being dispensed.



Lincoln Lubreel

Timer for Full-Automatic or Semi-Automatic Control

General Control Co., 1200 Soldiers Field Road, Boston 34, Mass., announces a new electronic timer, the Promatic, featuring accurate control of industrial processes under virtually any condition of temperature and humidity.

Promatic timers allow either full-automatic or semi-automatic control of the equipment to which they are connected. Two or more timers may be used to control a number of individually timed operations in a predetermined sequence — with either self-recycling or manual recycling.

Control of the timing period is by means of a plug-in type condenser unit and a variable resistor. The resistor control has a graduated dial. One con-

Needle Bearings can Boost Production, too!

One good way to give your production a lift is to simplify design problems and assembly operations through the use of Torrington Needle Bearings.

The compact unit construction of these modern anti-friction bearings speeds progress at every stage . . . from design to final installation. Needle Bearings require only a bore machined to proper dimensions for the housing . . . installation is a simple press fit operation . . . no retainers or spacers are necessary to hold them in position. Thus, there are fewer production and assembly steps, fewer parts to handle and control when Needle Bearings are employed.

Torrington Needle Bearings also help to improve product performance. Their high radial capacity and compact design saves space and weight, and their efficient lubrication means better operation, less maintenance, and less time out for servicing or overhauling. So, production is aided in this way too—by keeping tools, machinery and handling equipment on the job.

Let our engineering department show how you can boost *both your production and your product's efficiency* through these and other Needle Bearing advantages. Write for our informative Catalog No. 32.

THE TORRINGTON COMPANY
TORRINGTON, CONN. SOUTH BEND 21, IND.
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TORRINGTON NEEDLE BEARINGS

Promatic timer

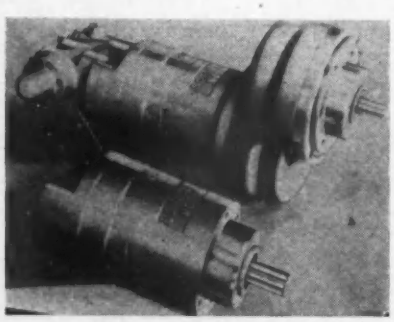
denser unit is supplied with each timer to obtain the timing period specified.

Five timing periods are available, in ranges of ½ cycle to 1.2 sec, ½ sec to 8 sec, ¾ sec to 15 sec, 1.5 sec to 30 sec, and 3 sec to 60 sec. The Promatic timer is available in both 110- and 220-volt types, 60 cycles, alternating current—with relay contacts rated at 10 amp. Timers for operation on direct current also are available, on special order.

Versatile Fluid Motor

A versatile fluid motor is the latest addition to the line of the Denison Engineering Co., Columbus 16, Ohio. This new fluid motor of axial piston design is available in a 3-hp and 5-hp capacity, with or without a speed control valve, with or without a choice of geared-head units of various gear ratios, and with a selection of brackets for mounting the motor with equal operating efficiency in any position desired.

The motor proper features a floating drive, wherein constant pressure contact is maintained between the driving and driven elements without the use of mechanical linkags or connecting rods of any kind. It is said that this eliminates the destructive effects of backlash or inertia resulting from sudden starts, stops and reversals, such as might be found in operation of indexing tables, etc. The motor is fully self-starting, operates equally efficient in either direction, can be instantaneously reversed, and is completely self-lubricating.



Denison fluid motors

G-E Offers Improved Sealed Beam Headlamps

By increasing the wattage from 40 watts in the driving beam and 30 watts in the passing beam to 45 watts in the driving beam and 35 watts in the passing beam, the General Electric Co., Schenectady, N. Y., now offers an improved Sealed Beam headlamp with 16½ per cent more light in the lower passing beam and 12½ per cent more light in the upper driving beam. The new lamps, approved by State authorities, will continue to carry the well-known 4030 number.

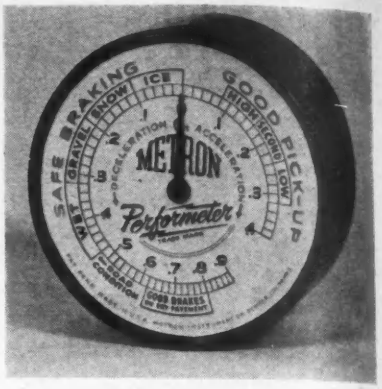
Improved Spark Plugs for Commercial Vehicles

AC Spark Plug Division of General Motors, Flint 2, Mich., is in production of a line of ceramic insulator spark plugs for commercial vehicles. These spark plugs are said to have a wider heat range in each thread size and to accommodate a wide range of engine operating conditions. The ceramic insulator is an AC development out of which came the ceramic aircraft spark plugs for bombers and fighters of World War II.

Instrument Measures Performance of Vehicles

The Metron Instrument Co., 432 Lincoln St., Denver 9, Colo., has just put on the market an instrument known as the Performeter for measuring the braking action and acceleration of motor vehicles. This unit is completely self contained and requires no electrical or mechanical connections to the motor or other parts of the vehicle. It comes equipped with a universal mounting arm.

This instrument is a pendulum type accelerometer with a pendulum geared to an indicating hand and measures actual motor and brake performance while the vehicle is in motion. It can be used for testing the brakes, testing the pulling power of the motor, testing the compression of the motor and to show safe braking areas under adverse road conditions.



Metron Performeter

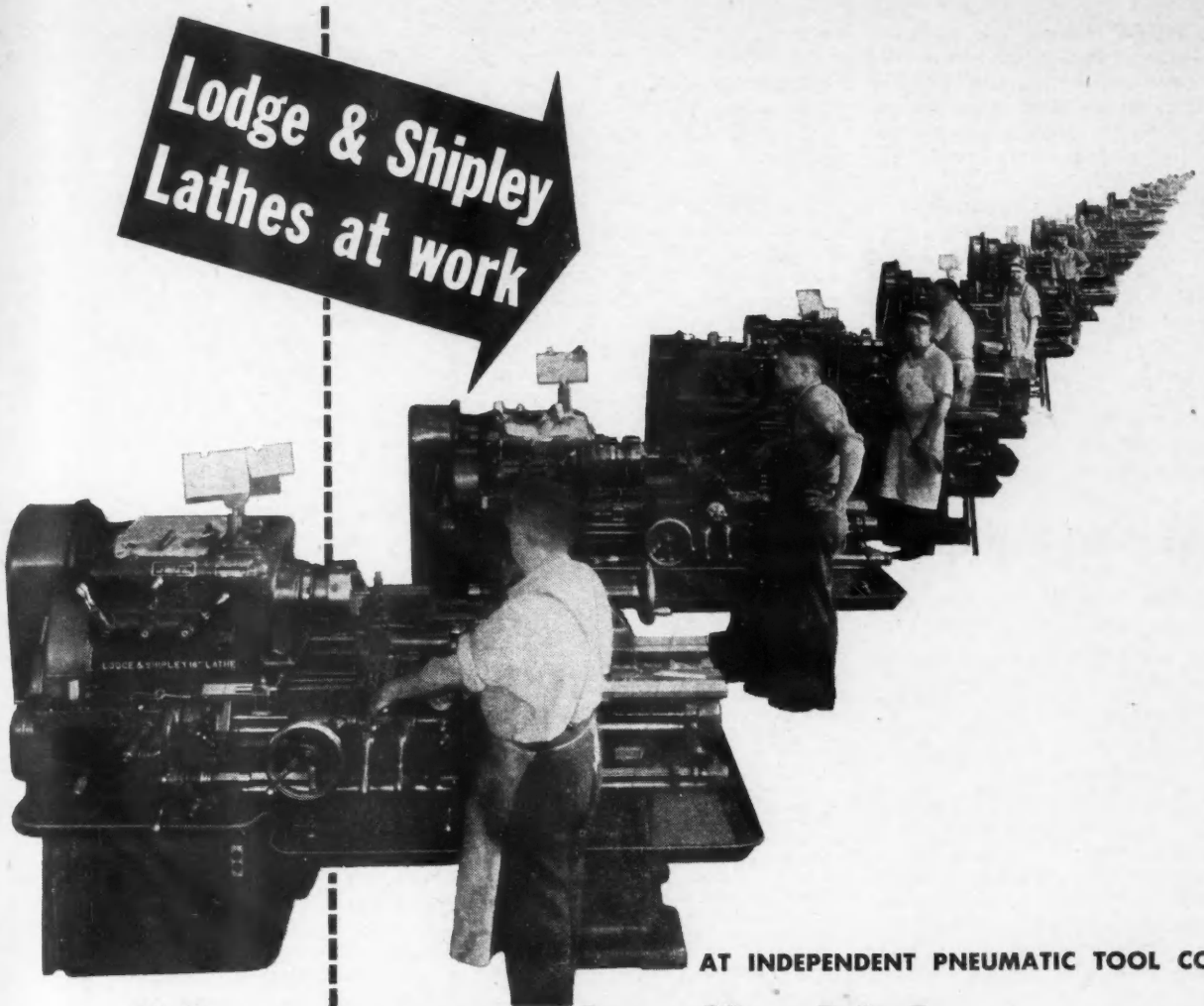
New Gaging Instrument

A gaging instrument known as the Measuray is now being offered to industry by the Sheffield Corp. of Dayton, Ohio. It utilizes an entirely new X-ray and electronic application for non-contact, continuous or spot checking of thickness of all types of moving materials.

The Measuray can be applied to almost any production process where it is desired to measure and regulate the thickness of material. Accuracy can be held to better than one per cent of material being checked if required. It is suitable for use with metal, paper, plastics, composition material, film, rubber, cellophane in the form of sheets, or foil of any kind. Metal foil can be checked for thickness to an accuracy of one per cent just as easily as sheet materials 3/16 in. thick. Concentricity can likewise be checked to measure a wire surrounded by insulation.

Tolerance and thickness limitations are dependent to some extent on the density of the material to be checked. Precise accuracy is maintained regard-

Sheffield Measuray



AT INDEPENDENT PNEUMATIC TOOL CO.

"Output exceptionally high . . . in hundreds of experimental jobs!"

"Something special" is an understatement of the experimental work done at the Independent Pneumatic Tool Co., Aurora, Illinois. Everything is special—hundreds of varieties of parts for Thor portable power hand tools—universal and hi-frequency electric and pneumatic types.

In the illustration, Independent's battery of 16" Lodge & Shipley Lathes is producing cylinder bushings, motor housings, throttle valves and air regulator parts. Practically every type of cutting tool is used in working all ferrous and non-ferrous metals. In "every conceivable machining operation", Independent states, "production is exceptionally high . . . beyond expectation." Time savings up to 20 per cent are reported.

Lodge & Shipley Lathes, as this user reports, "are high quality tools, meriting the consideration of anyone intending to purchase this type of equipment."

Call in L & S Engineers for expert advice on any lathe problem. They will be glad to demonstrate the many advantages of L & S Lathes on your work. Write on company letterhead for condensed catalog showing complete line.

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less of whatever changes may occur in the product. Speed of movement of material, whether at the rate of 5 fpm or 5000 fpm, has no effect on the accuracy of the Measuray. Neither does the temperature of the room, nor of the stock.

The Measuray is a comparator. It compares the thickness of material with a sample of the same material which has the required known dimension. The variations of thickness are indicated in percentages. Standard units are equipped with indicating mechanisms, while recording and machine control devices are available.

No contact is required with the material to be gaged, and in some cases the nearest approach of any mechanical part of the instrument can be many inches away. Material being checked can move or whip up and down within practical limits in the space between the X-ray source and the detector without disturbing the accuracy of this instrument.

The gage head is placed at a convenient location at any desired distance and can be so located that the moving stock passes between the X-ray source and the detector. The electronic power supply and amplification units may be set wherever desired.

Four standard Measuray units are available. Thickness, density and type of material, as well as tolerances to be checked, determine which of the four units is to be applied.

Production Equipment at Studebaker

(*Continued from page* 35)

Ends and flat are burred in a Blount polishing stand and the pins are finish-ground and lapped in a battery of two Cincinnati Centerless grinders fitted with the Danley Feedmatic through feed.

The pins are held to close tolerances on the diameter while surface finish is held to two-four michro-inch (rms).

Although the cast camshaft permits of considerable economy in fabrication, it has some design features which require numerous special operations. This will be evident in following the routing reproduced below. Among the equipment listed on the routing are Norton and Landis grinders, two Lo-Swing lathes, a new type of turret lathe—the 16-in. electric cycle Warner & Swasey turret lathe with automatic control of spindle speed and feed—and a battery of completely automatic Norton Cam-O-Matic grinders. Another important piece of equipment is the small but very effective No. 0-8 Cincinnati automatic plain milling machine with rise-and-fall feed. This type of machine has given excellent service on a number of parts which require the cutting of keyways.

CAMSHAFT ROUTING OPERATION AND EQUIPMENT

Grind gear blank—**10 x 36 Norton Grinder.**
Rough grind front and front center brgs. Rough grind rear and rear center brg.—**10 x 36 Landis Grinder, double wheel.**
Turn gear fit diameter, face front brg. radius gear blank and chamfer (2) center brg., frt. brg. and gear fit—**Lo-Swing Lathe.**
Special under cut frt. brg. gear fit, turn gear fit, drill, ream thread relief tap and recenter, face frt. brg. to proper spacing and undercut gear fit, chamfer 3 frt. brgs. and gear fit and radius gear blank, blow out thread—**16 in. Electric Cycle Warner & Swasey Turret Lathe.**
Drill oil holes in frt. and rear brgs. and c'sink oil holes in frt. brg.—**Avey drill and Speed Head.**
Cut keyway, keyway to be on centerline of No. 1 exh. cam 17/32 in. from face of gear fit to center—**O-8 Cincinnati Auto Plain Mill with Rise & Fall Head.**
Rough grind all cams—**5 x 30 Norton Cam-O-Matic Grinder.**
Semi-finish grind 2 center brgs. and gear blank—**Type D.C. Plain Hydraulic Landis Grinder, 3 wheels.**
Check for straightness, check between centers and hole to within .001 indicator reading on all bearings—Straightening fixture with centers attached welded to a section of the conveyor.
Cut gear and blow off chips, 10 teeth—12 pitch 1.4967 PD 1.6633 OD—**Model 7A Lees Bradner 5 Station Auto Hobbing Machine.**
Finish grind cams—**5 x 30 Norton Cam-O-Matic.**
Inspection—Bench.
Parkerize—**Speed Lathe & Parkerize.**
Burr centers—repair—**Ex-Cell-O Lapper.**
Straighten—Hand screw press.
Finish grind 2 centers brgs. and rear brg. —**Type D.C. Plain Hydraulic 10 x 30 Landis Semi-Automatic Grinder.**
Finish grind front brg. — **10 x 36 Norton Grinder.**
Finish grind gear fit and thrust face of front bearing—**Landis 10 x 36.**
Polish bearings, radius rear bearing, punchout oil holes with wire and wash—**Greenfield Speed Lathe** in connection with wash tank.

The cylinder block is truly the backbone of the engine and represents more process than any other part of the mechanism. Because of the large number of steps in the machine shop, we shall content ourselves with a brief high-spotting of some of the major operations.

Among the latest items of equipment on the line is the special transfer-type Ingersoll milling machine which contains five milling stations and holds seven blocks at a time. With cemented-carbide milling cutters, this equipment removes metal at the rate of 48 in. per min. The sequence of operations in this machine is as follows: rough- and finish-mill the top and bottom face; rough- and finish-mill manifold and valve cover face; rough-mill bearing locks. The unit has a built-in chip conveyor.

The diameter of the upper half of the main bearings and the bearing locks are finished in one pass in a long, horizontal Cincinnati hydraulic broaching machine built directly under the gravity roller conveyor.

Drilling of nine holes in the rear face and counterboring for Welch plugs, the drilling of 15 holes in the front end and drilling two oil gallery holes is done in a Greenlee two-way, four-station transfer machine.

Semi-finish reaming of valve guide holes and tappet holes is done in one setting in a Foot-Burt 12-spindle machine with hydraulic feed. After finish reaming of these holes, the valve guides are pressed-in on an OilGear hydraulic press.

Another touch of advanced practice is found in the installation of a group of three No. 61 Ex-Cello-O angular precision boring mills of six-spindle type used for finish boring of cylinder bores, following four preparatory Foot-Burt boring operations. These units have a fully automatic cycle so arranged that all cutting tools line up in the same position when the boring cycle is completed. The fixture then moves slightly forward to clear the cutters as the heads move upward in readiness for the next cycle, thus preventing the scoring of the bores.

As we move along the line, we fined a group of Greenlee transfer machines and tapping machines. First of these is a two-way transfer machine with horizontal and vertical drills, composed of two stations with one tapping spindle for drilling and chamfering eight bearing cap stud holes, drilling 15 holes in bottom flange, and miscellaneous holes. Next is a two-way, four-station transfer machine for drilling a group of pad holes. Fifty holes are tapped around the top, sides, and ends in a 5-way Greenlee tapping machine in one setting, while 49 holes are tapped in a three-way Greenlee tapper.

An Ingersoll two-way boring machine is used for rough-boring cam bores, semi-finish-boring crankshaft bearing seats, and rough-boring the water pump hole. An adjacent Ingersoll horizontal boring machine finish-bores the camshaft bearing holes, finish bores the crankshaft bearing seats, finish-reams the water pump hole. Following the eccentric milling of the oil slinger groove and facing the front, the camshaft bearings are pressed in on an OilGear horizontal hydraulic press. The bearings are line reamed in an Ingersoll boring mill.

Honing of the cylinder bores is done in two operations—rough- and finish-honing in two six-spindle Barnesdril machines fitted with hydraulically operated Micromatic hones. The bores are gaged and marked for size for selective piston fitting.

It may be observed from the foregoing that Studebaker has approached the principle of the process line with the use of individual transfer machines spotted along the line but has maintained flexibility of operation in keeping with its volume of production.

Bell housings have the inner and outer flange faces finished from the rough casting by grinding instead of the conventional method of milling. This is done in a new three-wheel Hanchett surface grinder fitted with a rotary indexing table having eight sta-

(*Turn to page* 60, *please*)

(Advertisement)

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sees many

GOOD THINGS AHEAD

It is reported that . . . . . .

The Army and Navy are studying our natural caves, such as Carlsbad and Mammoth, in order to determine their usefulness as war-time shelters for industry.

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Weirton Steel Co. now pipes oxygen around its plant like water.

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Centrifugal casting of plastics is claimed by Rezolin Co. of Beverly Hills to offer the same advantages that the process does to the casting of metal.

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Dow Corning has tested paints made from silicone resins and aluminum powder on diesel manifolds and furnace doors at temperatures as high as 600 degrees Fahrenheit.

get ready with CONE for tomorrow

A joint committee of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers has standardized the sizes of large steam turbines and the first standard unit for electric power generation is now under construction.

get ready with CONE for tomorrow

Federal Telephone and Radio Corp. claim that their new small-size selenium rectifier can replace as many as 29 different rectifier-type tubes now used in radio receivers.

get ready with CONE for tomorrow

International Business Machine Corp. is offering the Chinese a typewriter that will print 5,400 ideographs by the use of 43 keys. An experienced user can write about 45 words per minute (English record 149).

get ready with CONE for tomorrow

American Steel and Wire Co. has a quarter-inch nail that can be used to tack tags to cold steel ingots.

Texaco has developed a new synthetic grease for aircraft instruments, controls, cameras and small motors that is usable from 100 degrees below zero to 300 degrees above.

get ready with CONE for tomorrow

Recent tests indicate that the new railroad car stabilizer, developed by Westinghouse from the gyroscopic tank gun mount, shows great improvement in riding comfort over all kinds of roadbeds.

get ready with CONE for tomorrow

Welded tubular chassis, helical springs, independent axles, 1000 pounds less weight and a lower powered engine are among the details of the proposed new low-priced Chevrolet.

The new Duco Metalli-Chrome automobile lacquer uses particles of aluminum to give a metallic luster and is made in 200 colors.

get ready with CONE for tomorrow

Slight bends in the last threads of a new lock nut made by Grip Nut Co. permit it to turn freely through most of its travel, yet prevent it from loosening when finally set up.

get ready with CONE for tomorrow

United Engineering and Foundry will pour a 243-ton casting for a press base which will take one month to cool and another month to anneal.

get ready with CONE for tomorrow

University of California scientists have produced a standard for the measurement of length ten times as accurate as the cadmium light ray now accepted by using a light wave from transmuted mercury (made from gold) excited by a high frequency radio beam.

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AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U.S.A.

84

tions—four for the outer face, four for the inner face. This requires two operations in the machine to finish the bell housing. The job is done at the rate of 100 pieces per hour. Tolerances on this operation are extremely fine. The height from face to face is held to 0.004 in., while both faces are held to 0.0015 in. for flatness and parallelism.

Cylinder head milling affords direct comparison of the productivity of old and new equipment of the same type and make. Here are two rotary table mills set side by side—one new, the other old. The new machine removes metal at the rate of 41 in. per min., while the old machine has a surface speed of but 25 in. per min. Both are fitted with cemented-carbide-tipped milling cutters.

The flywheel starter gear operation begins with special rectangular section bar stock which is rolled in the form of a spiral in a No. 16 Kane & Roach roll, to produce six rings at a time. These are cut off on a Johnson band saw. The work is then pickled and washed, goes to a Federal butt-welder for flattening and butt welding of the joint. The rings are normalized in a rotary type Surface Combustion furnace and the flash sheared off in a No. 41 Bliss horn press. They are then expanded to size in a special expanding machine, heated and re-struck in a 2000-lb board hammer.

Rough and finish boring and chamfering is done in a double-indexing, six-spindle, Bullard Mult-Au-Matic, indexing two stations at a time. In the first position, two stations load, the rough blank being located from the OD and clamped on the side. In the second position, two stations rough bore and chamfer. In the third position, two stations finish bore. LeBlond 20-in. lathes are used for rough- and finish-straddle facing and turning OD and breaking corners.

Gear teeth are cut in Gould & Eberhard vertical hobbing machines in a stack of 25 blanks at a time. Unique piece of equipment for chamfering gear teeth is found in a Barber-Colman unit adapted from a standard B-C hobber minus the overarm.

Following stamping of part number and washing, the gear is hardened in a General Electric induction hardening machine, dipped in anti-rust, and proceeds to assembly with the flywheel and balancing of the assembly in a Micro-Poise balancing machine.

Major operations on the flywheel are handled in a battery of Gisholt Simplimatic lathes fitted with large cemented-carbide-tipped lathe tools arranged for plunge cutting. One machine finishes the clutch face, a second machine is set up for finishing the front face. Finish boring is done in No. 12 Gisholt lathes. An interesting development here is the adoption of the three-station No. 41 Heald precision boring machine for simultaneously finishing the clutch face to a fine surface finish and finish turning the ring gear diameter. Facing is done with a planer type tool tipped with cemented-carbide. Unique feature of this machine is its fully automatic cycle and variable speed of the work spindle for facing so as to maintain uniform cutting speed. The OD turning tool comes in first and completes its operation. On the return of the cutting spindle, the facing operation begins, first with work rotating at high speed at the small diameter then progressively reducing speed to the outer periphery.

Two outstanding examples of modern practice are found in special machines built by Baker Bros., for several front suspension parts. The machine, illustrated, is tooled for the steering knuckle upper support arm bracket, a U-shaped stamping with heavy bosses. It is a two-way, horizontal unit with an indexing drum-type fixture. The operation is to drill, ream, chamfer and tap in one setting.

The second machine is even more complicated, being a Baker three-way machine with drum type indexing fixture with two heads for threading the ends of the steering knuckle lower support arm inner shaft, the third head being used for drilling four mounting holes. The ends are turned and chamfered at one station using Genesee hollow mills with turning and chamfering blades. Threading of the ends is done at another station using 1¼ in. type "L" Landis die head with chasers.

Both machines have fully automatic cycle with hand clamping of work in fixtures, using a cam-lock type clamp.

As mentioned earlier, Studebaker has tooled a considerable number of parts for surface broaching. All of the broaching equipment was supplied by Cincinnati, most of the machines being of vertical Duplex Hydro-Broach type with the table fitted with two indexing fixtures. Broaches for this equipment were supplied by Detroit Broach. Generally speaking, cutting is done at a ram speed of about 27 fpm.

Among the parts finished by surface broaching is the steering knuckle pin upper arm support. This is a Tee-shaped forging, made in rights and lefts. The four end faces of the Tee are finished in the broaching machine.

The steering knuckle pin has two parallel bosses finished by broaching in a 10/54 Cincinnati vertical Hydro-Broach. The steering knuckle assembly has its upper and lower faces finished by broaching in 10/54 Cincinnati vertical Hydro-Broach.

Crankshaft bearing caps—cast iron—all are finished by broaching. One example is the rear bearing cap, the operation being—broaching the half bore, flat mating face, bearing locks, and chamfer broaching the rear face. The broaching tools for this job comprise 19 different sections.

As mentioned earlier, the foundry has undergone considerable change and mechanization including an extensive sand handling system installed by Bartlett-Snow. The Champion block is molded two in a flask, using the new sand slinger for making up the cope and drag sections. Another sand slinger is installed for making Commander blocks which are molded one to a flask. Each of the sand slingers is served by a three-station rotary indexing table in the floor. Pouring is done on mechanized conveyor lines. The foundry is exceptionally clean, cool, and well ventilated by virtue of its high ceiling.

It is of interest to find that the press shop is currently operating with 1200 different dies, a good index of the variety of stampings produced here. Interspersed on the press line are six of the new Clearing presses which were installed recently.

Paris Show Revived

(*Continued from page* 26)

this being a unit with the power plant, and normal half-elliptic springs at the rear.

Skoda shows a central backbone box-section chassis, with forks in front to receive the vertical all-aluminum, four-cylinder, overhead valve engine of 37.55 cu in. having a 2.76 in. bore and a 3.15 in. stroke. The car has a four-speed transmission with a 20 per cent overdrive, and front wheel drive. Radius arms from two steel transverse tubes welded to the backbone give the anchorage for the rear wheels, and suspension is by means of a single transverse spring, the ends of which are anchored in two half spheres.

Bugatti has probably the smallest four ever built for road use, this being a 21.35 cu in. engine with two overhead camshafts, a Rootes-type blower with the carburetor mounted directly on it and a four-speed transmission. Except that the engine runs at 8000 rpm, little information is available regarding it. Indications are that Bugatti will use this in a small two-seater. A second engine is a 91.55 cu in. supercharged job, having all the usual Bugatti features, but regarding which no information has been released.

France is sponsoring small, cheap, light, two-seater baby cars officially known as "motocars." In this class, the Rovin has a single-cylinder, two-stroke engine of 15.87 cu in. displacement, with a 2.76 in. bore and a 2.64 in. stroke. The engine is mounted at the rear and has forced draft for cooling. The car has a sheet-steel, spot-welded open body, weighs 530 lb and has a speed of about 40 mph. Another in the same class is the Julien, in two types, one having a single-cylinder, 12.2 cu in. engine at the rear; the other a flat twin of 36.6 cu in. displacement in front. This latter is a four-passenger

(*Turn to page* 62, *please*)

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40—14

model with coil spring suspension in front and torsion bars at the rear. Welded pressed steel construction is used, chassis and body being a unit. This type of vehicle is a return to the "cyclecar" of some 30 years ago and its justification is the extreme economy imposed on Europe by postwar conditions.

High-grade, high-powered cars are not numerous. Delahaye has produced a new six of 3.31 in. bore and 4.22 in. stroke, using three carburetors. The oil radiator is mounted in a channel-section chassis of particularly rigid construction due to the welded cross members. The Dubonnet suspension is used in front, this being its first production in France. The differential housing is bolted to the chassis cross members, and the De Dion type shafts pass through the side rails. The Cotal electro-magnetic transmission is used. In the past this firm used independent suspension by transverse spring and wishbones.

Talbot (Darracq on foreign markets) has a new 274.5 cu in. engine with two camshafts and valves in the head operated by pushrods and rockers. It has a seven bearing shaft, a compression ratio of 7, two carburetors and is stated to develop 170 hp at 4200 rpm. The chassis has the Wilson preselective transmission with a synchronized clutch, and is the only car on the Continent using this transmission.

To summarize, general tendencies are small, economical, light cars; a very extensive use of light alloys; unit construction of chassis and body; independent suspension all round; and a growing use of torsion bars for both suspension and valves. Streamlining is being given much attention. Automatic transmissions are not being used at all, probably because of cost. The only real rival to the gear type transmission is the Cotal planetary magnetic, and this only for the higher-priced cars.

More space is occupied in the show by trucks and coaches than by passenger cars, and much new material is on view. The use of light alloys is extensive, and even on conventional type trucks, is taking the place of steel stampings for such parts as valve covers, oil sumps, pump housings, timing-gear housings, transmission housings, air compressors, etc. However, there are many other applications. Marrel shows a hand-operated dump body, entirely in aluminum and magnesium alloys, which is mounted on a Ford truck. On a Bernard Diesel three-axle chassis, there is mounted a 5820 gal gasoline tanker having three compartments, and weighing only 3520 lb. Latil, also with a three-axle Diesel-engine chassis, has a tanker of the same capacity weighing 3300 lb.

Georges Irat has a chassiless 264 gal tanker entirely in light alloy, with a dead weight of three tons for a total weight of eight tons. The tank itself is in duralinex, the tubular front axle is in duralumin, and the cab is in sheet aluminum. The motor is a four-cylinder Diesel of 3.94 in. bore and 5.12 in. stroke, transmitting its power through an eight-speed Cotal transmission to the front wheels, which are independently sprung. The tank, which is in six compartments, forms the backbone of the machine, and the rear end is attached by a pair of triangular tubes to the independently sprung rear wheels.

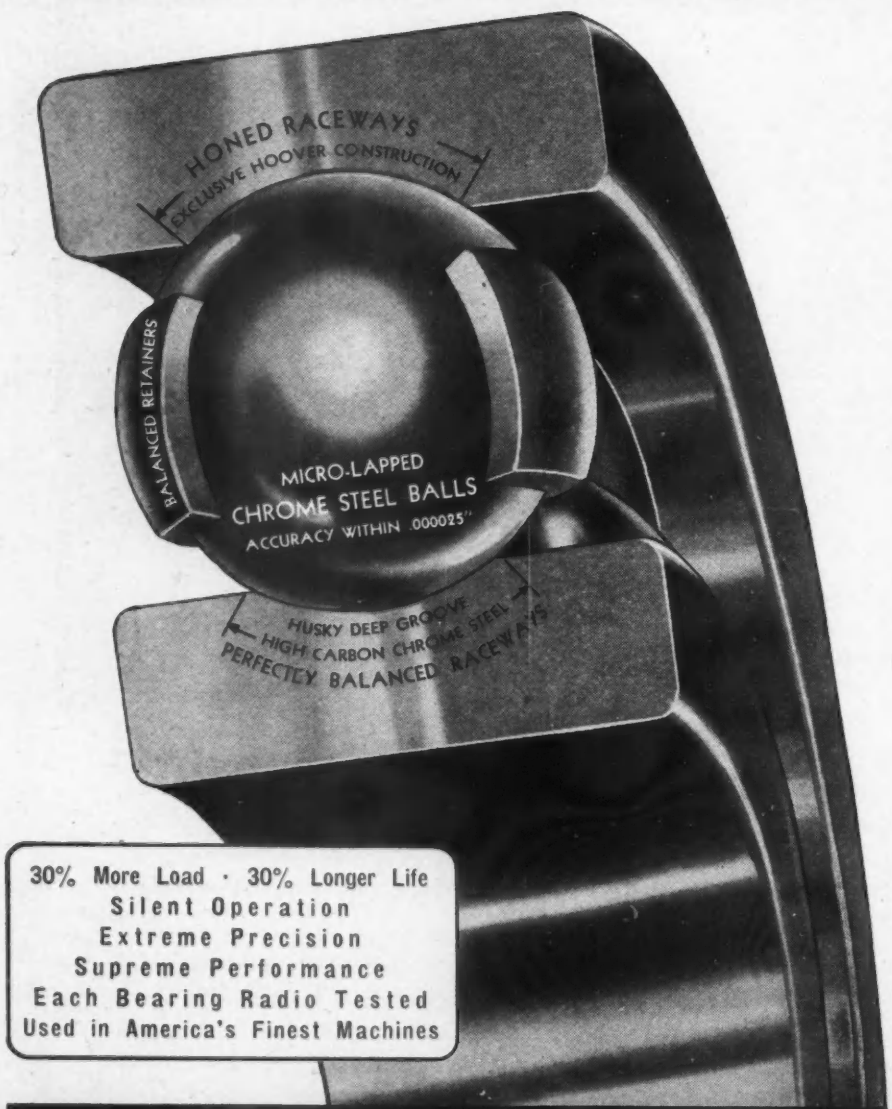
There is a pronounced move towards large capacity trucks. Willeme has a straight-eight Diesel of the Deutz type, 5.12 in. bore and 6.70 in. stroke, the power output of which is said to be 230 hp. A six and a four are built to the same dimensions to assure interchangeability of parts. Aluminum alloy is used for the crankcase, which has a deep, large capacity oil sump at the rear. Wet liners are used, there is a separate head per cylinder, and a chromed nine-bearing crankshaft.

The chassis has two overhead-worm, live axles, with a differential between the two, an eight-speed transmission and air brakes. Air brake cylinders are mounted on the top of the axle housings. Oil cylinders with wick feed are provided for all brake control

(*Turn to page 64, please*)

So much more...for so little more

AMERICA'S SUPER FINE BALL BEARING



30% More Load · 30% Longer Life
Silent Operation
Extreme Precision
Supreme Performance
Each Bearing Radio Tested
Used in America's Finest Machines

HOOVER

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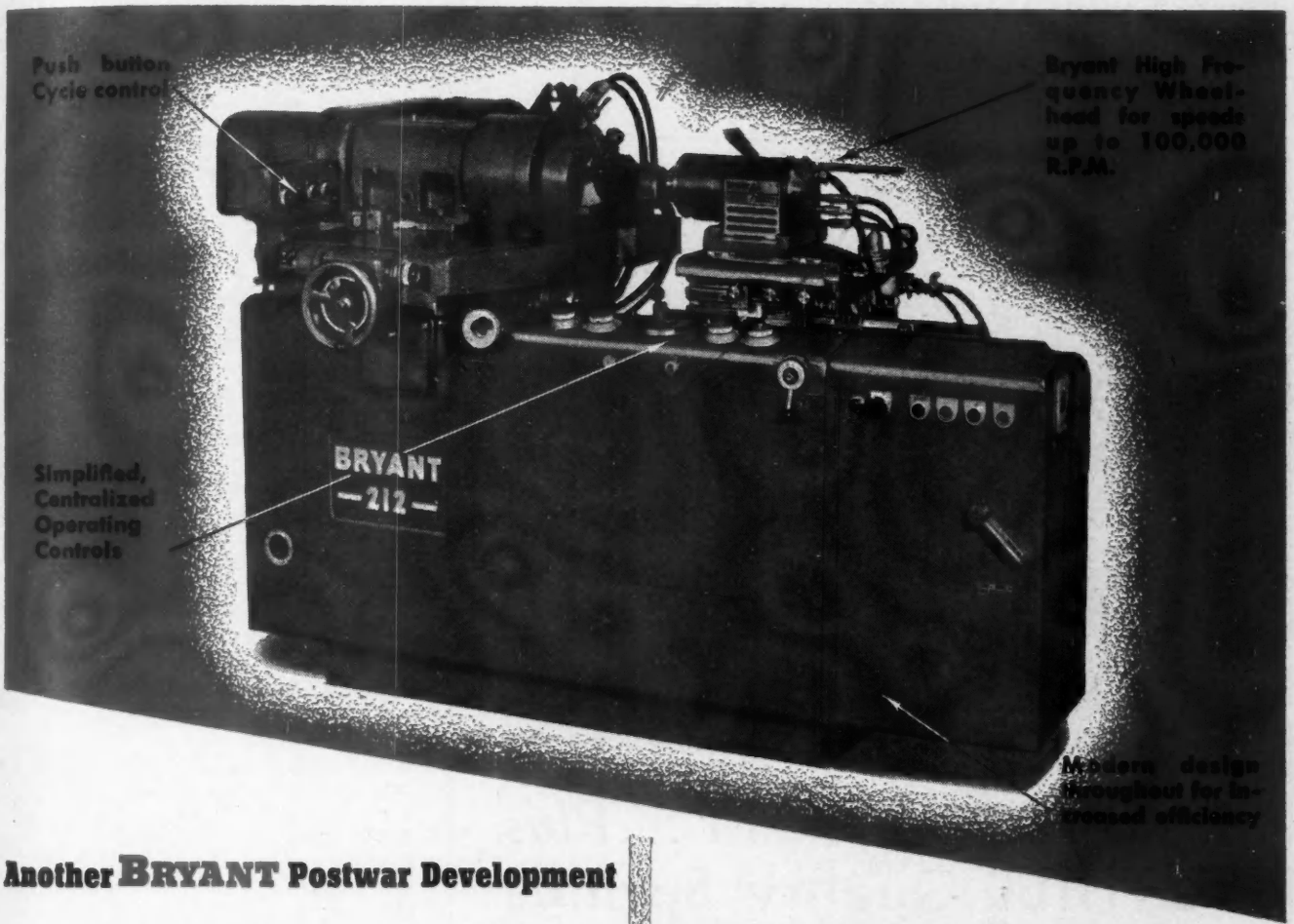
HOOVER BALL AND BEARING COMPANY, ANN ARBOR, MICHIGAN

Announcing a New Automatic High Production Internal Grinder

No. 212


Push button Cycle control
Bryant High Frequency Wheelhead for speeds up to 100,000 R.P.M.
Simplified, Centralized Operating Controls
BRYANT
—212—
Modern design throughout for increased efficiency

Another BRYANT Postwar Development

The new No. 212 Bryant Grinder is designed to fill the pressing need for greater production per man hour. It is a fully *automatic* internal grinder that requires a minimum of operator attention—in fact on many jobs one man can run two machines. Production is higher, more precise and more profitable with this new grinder.

The new No. 212 Bryant roughs and finishes bores from 5/16" to 6" (approx.) in diameter in lengths up to 3 inches. On the smaller bores, it is especially suited to the use of *Bryant High Frequency wheel spindles which operate at speeds up to 100,000 r.p.m.*

The No. 212 design incorporates the superiority of Bryant three point wheel slide suspension and insures maximum rigidity under all conditions. Movements of the machine are hydraulically operated, while the cycle is controlled electrically to facilitate change-over. Sizing is accomplished accurately and automatically by any one of three methods: a plug gage mounted in the work spindle, a diamond tipped bore contact, or controlled by the wheel truing diamond. It *roughs* and *trues* and *finishes* and stops *automatically*—producing parts with fine work finish to tolerances that insure bores that are straight and round, making the products which you manufacture more desirable because they run smoother and live longer.

If grinding figures in your production plan, your move for best results is to—

SEND For The Man From Bryant.

BRYANT

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

parts which are not readily accessible. Using a trailer, total useful load of this truck is stated to be 100 tons.

Bernard shows an 18 ton, six-cylinder Diesel, with side rails of unusual depth and the axle going through them; a 23 ton, three-axle chassis with a six-cylinder Diesel is presented by Rochet Schneider and trucks of the same capacity are shown by Latil, Berliet and Saurer.

The Hesselman engine has been adopted by Somua for a seven-tonner. It has a bore of 4.65 in. and a stroke of 5.91 in., and is the only one of its type in the show. The five-speed transmission is separate from the engine which is designed for easy withdrawal on its sub-frame. This is a feature which has been developed by several other makers, notably Panhard and Chausson.

Light-weight coaches with rear engine mounting are a prominent feature. De Dion Bouton, in conjunction with Million Guiet, show a 40-passenger coach, all seats facing forward, with a rear engine and rear wheel drive. The power plant is a Hotchkiss six-cylinder engine of 3.39 in. bore and 3.94 in. stroke, driving through a seven-speed and reverse transmission, the seventh being an overdrive. The engine is governed to 3000 rpm on six gears and 2200 rpm on the overdrive, with a safety device cutting down to the lower figure if it is tampered with. The mounting is vertical, fore and aft, giving a clean platform on which the mechanic can sit for motor adjustments. Air is admitted at the top rear of the body and carried through a long filter across the cab to the downdraft carburetor. Controls comprise an electric lamp before the driver showing red when the oil pressure falls below a determined figure, and warning lamps for water level and temperature. It is considered better to give the driver an electric warning, obliging him to go to the engine, rather than fit distant gauges. The body construction is rectangular section tubing, electrically welded, with non-stressed aluminum covering. Chassis and body are a unit. Dead weight is 4½ tons and total loaded weight eight tons.

Tubauto also shows a 40-passenger chassiless coach with two types of rear engine. On one of these, two four-cylinder, overhead-valve engines of 3.27 in. and 3.90 in. bore and stroke are coupled by means of spiral bevel pinions to a fore and aft shaft of a four-speed transmission. From this the power is carried forward by an open propeller shaft to the rear axle which has a light-alloy housing. The second combination is a four-cylinder Diesel of 4.33 in. bore and 5.91 in. stroke set across the rear and linked up to a four-speed transmission. The power is carried forward in the same way as the other type. The radiator is completely shrouded and air is drawn through it by means of a turbine, then discharged at the rear. The body construction is of rectangular section tubes measuring 1.85 in. by 0.079 in. with a thickness of 0.039 in. and has a sheet steel body covering of 0.039 in.

The Chausson chassiless coaches are all metal, of spot-welded construction and have a forward engine. Also by the same firm was shown a small 10-passenger coach with a twin-cylinder, two-stroke motor under the floor at the front and driving the front wheels. Lorraine (formerly Lorraine-Dietrich) also displayed a rear engine 40-passenger coach.

The French Society of Automotive Engineers (SIA) in conjunction with the Centre of Technical Studies (CTA) makes a good display. This latter body, which operates the French automobile laboratory, has recently carried out a series of wind tunnel tests on full sized cars: with wheels fixed and revolving, with a head wind and side winds at various angles, and with radiators exposed and covered. These will be followed by wind tunnel tests on models to one-fifth scale, to obtain the exact relation between a full sized car and the model. It has been felt that model tests have not been conclusive and these experiments will enable a formula to be determined for application to model tests. The final results are not expected for several months.

FWD HEAVY DUTY . . . *Plus* TUTHILL Quality Springs

OIL field service has its special requirements . . . of speed, adaptability, portability, safety . . . and trucks must be so equipped and designed as to meet these demands. All such vital factors are combined in this FWD Truck, the largest unit ever built by The Four Wheel Drive Auto Co.

To prevent side sway and provide rigid support for the chassis and oil well drilling and servicing equipment, this truck is mounted on TUTHILL Leaf-type Alloy Steel Springs. These Springs are standard on all types of FWD Trucks and Buses, and meet the severe service requirements *better* in all lines of industry.

Tuthill makes Leaf Springs in standard and special types. What are your Spring requirements?

TUTHILL SPRING CO.

760 W. Polk St.
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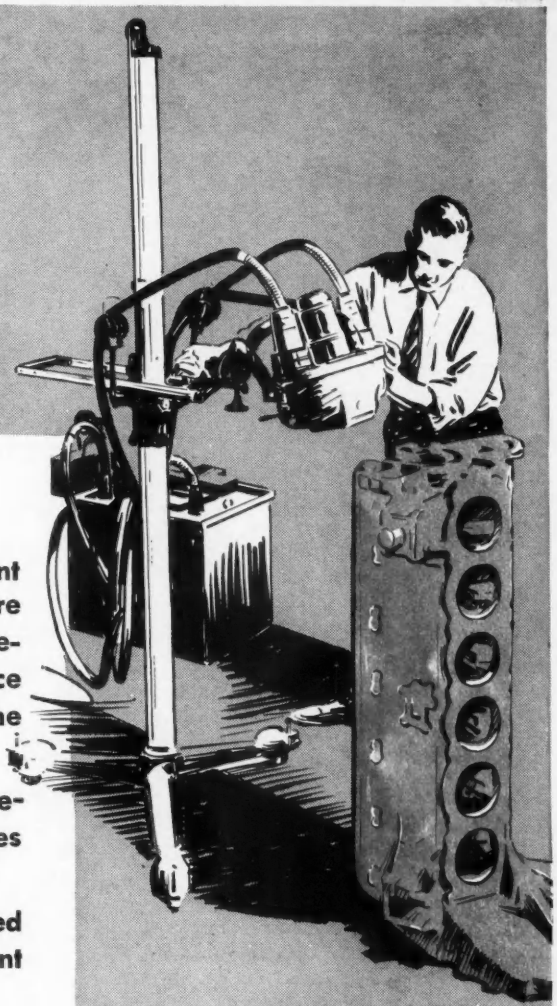
Quality Leaf Springs for Sixty-six Years

DOUBLE AA BRAND
ALUMINUM CASTINGS

AA



NEW USES FOR ALUMINUM—A recent survey reveals that there are today more than 3500 uses for aluminum. This represents a gain of 1500 applications since the last survey was made, before the war . . . and the list is still growing!

In designing a new product . . . or redesigning . . . it will pay you to investigate the advantages of this wonder metal.

America's finest heat-treated, laboratory-controlled Aluminum Alloy castings . . . either sand or permanent mold . . . will meet your most exacting requirements.

Double AA Brand Castings are structurally sound . . . weigh one-half to two-thirds less than iron castings . . . are easier to machine. And, because of the complexity of shape possible, one part will often serve where two or more would normally be required.

Our two big Detroit foundries are prepared to give you quick delivery.

Send for new fully-illustrated brochure which describes our complete production facilities.

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HEAT-TREATED CASTINGS

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Since 1925

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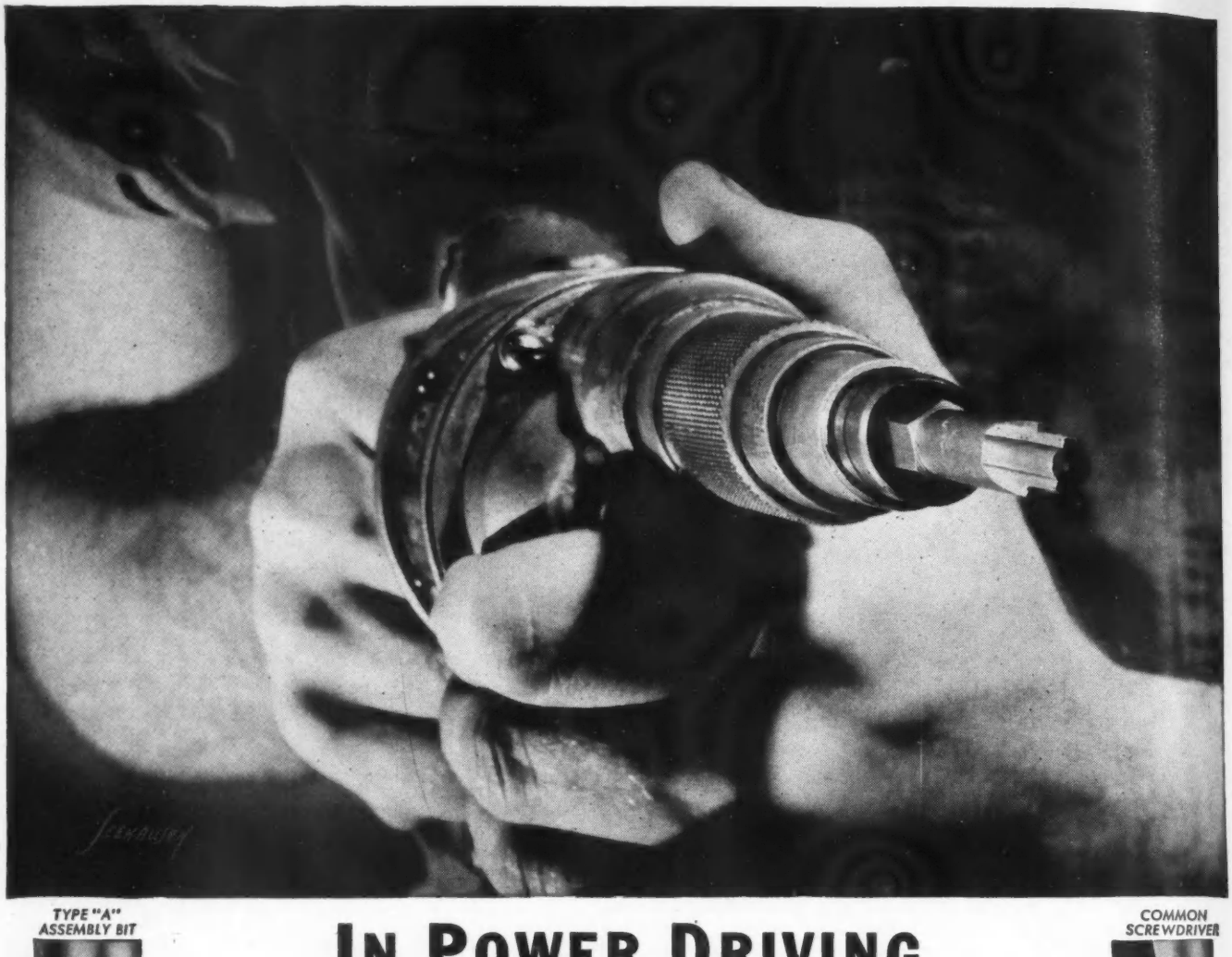
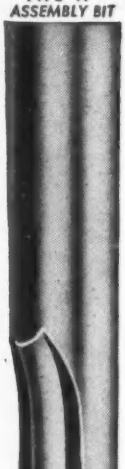
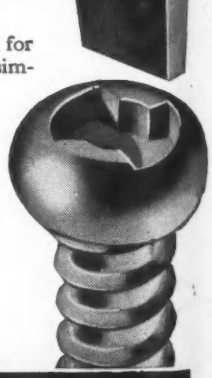


TYPE "A" ASSEMBLY BIT



COMMON SCREWDRIVER



IN POWER DRIVING

CLUTCH HEADS OUTMODE ALL OTHER SCREWS

Check This Point by Point Comparison

Regardless of the type of screw you are using now, *RECESSED HEAD OR OTHERWISE,* check their performance against the exclusive CLUTCH HEAD features that short-cut the way to safer, smoother, speedier, and lower-cost production.

- ✓ High visibility for an easy-to-hit target with resultant increased speed born of operator confidence.
- ✓ Automatic dead-center entry for sure straight driving. CLUTCH HEAD'S Center Pivot Column prevents driver canting.
- ✓ All-square engagement that eliminates "ride-out" (as set up by tapered driving)...disposing of slippage hazard and need for fatiguing end pressure.
- ✓ The CLUTCH HEAD Lock-On, uniting screw and bit as a unit for easy one-handed reaching to hard-to-get-at spots.
- ✓ The unmatched tool economy of the rugged Type "A" Bit which may be restored . . . *repeatedly* . . . to original efficiency by a 60-second application of the end surface to a grinding wheel.
- ✓ The only modern screw basically designed for operation with a common screwdriver to simplify field service.

Your request will bring sample screws, Type "A" Bit and illustrated Brochure

This Type "A" Bit is credited by an automobile manufacturer with driving 214,000 screws continuously and without reconditioning . . . on an operation calling for unusually high torque driving.

CLUTCH HEAD SCREWS

Service men and product users appreciate the convenience of making adjustments with an ordinary screwdriver which need only be reasonably accurate in width . . . the thickness being secondary.

UNITED SCREW AND BOLT CORPORATION

CLEVELAND 2 CHICAGO 8 NEW YORK 7

Gas Turbines of the Future

(*Continued from page* 41)

heat cycle which is 0.60 x 0.32 = 19 per cent. All heat above 684 F absolute in the propulsion jet is treated as a loss in the T-P entropy cycle. This loss amounts to 48 per cent and applying this value to the 19 per cent we have 0.19 x 0.48 = 9 per cent T-P entropy cycle value for jet thrust.

The T-P entropy analysis will be applied in the same manner for the high pressure cycle in order to make a true comparison. The high pressure cycle in Fig. 3A, which consists of a high pressure piston engine and high pressure turbine, requires the complete pressure drop must take place in a properly designed nozzle to qualify in converting pressure into velocity. The form of nozzle tried out consists of a special piston that opens an unrestricted annular port, which forms a part of the nozzle. It is important to note in Fig. 3A that the T-P entropy value for the piston cycle is 3335 T-P and for the high pressure turbine the T-P entropy is 4636 T-P. The combined value for both the piston and turbine is 68 per cent and the value of the heat cycle is 67 per cent. Therefore the value for the T-P entropy working cycle as shown is 45 per cent. Evaluating the piston engine cycle of Fig. 3A, the T-P entropy value of 29 per cent

$$\left(\frac{3335\ T\text{-}P}{6692\ T\text{-}P + 4636\ T\text{-}P}\right)$$

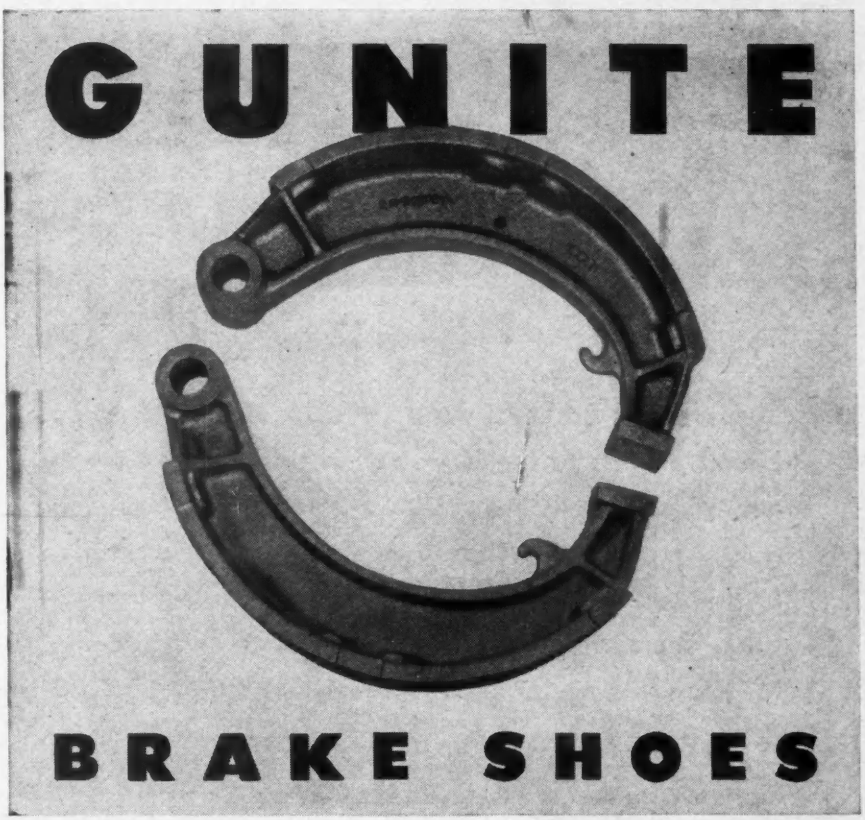
is combined with the heat cycle value of 67 per cent. This gives 19 per cent for T-P entropy working cycle of the piston engine.

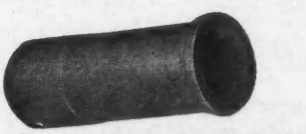
An example of the low pressure cycle turbine is the aircraft engine exhaust turbine, two types of which are the blowdown turbine and steady flow turbine. An analysis of them was presented in the paper, "NACA Study of the Utilization of Exhaust Gas of Aircraft Engines," by Benjamin Pinkel at the 1946 SAE National Aeronautic Meeting. The efficiency of both types is so close that one diagram, Fig. 3B, is used to show blowdown and steady flow cycles. The blowdown really takes place at the exhaust valve seat before it reaches the individual stack or manifold. Therefore, both types are blowdown with a slight difference in back pressure on the pistons.

In Fig. 3B the turbine T-P entropy cycle shows a net blowdown loss of 83 per cent and that the value for the combined piston and turbine T-P entropy cycle is 33 per cent. The T-P entropy working cycle is therefore 25 per cent for the blowdown engine as compared to 45 per cent for the full pressure turbine cycle analyzed in Fig. 3A. By using the same method of analysis it can be shown that the T-P entropy working cycle value for a higher pressure-jet propulsion engine is 37 per cent.

In view of the fact that no specific figures have been released by builders of low pressure jet turbine performance on fuel consumption per hp-hr, the Carnot cycle formula has been used to compare the efficiency of the jet engine. It is important to test the jet turbine on an axial thrust dynamometer to check the figures for jet thrust in pounds of fuel at delivered thrust horsepower.

The limitations of the low temperature, low pressure turbine heat cycle accounts for the extravagant fuel consumption ranging from 1.5 to 3 lb. of fuel per hp-hr. A high pressure turbine cycle is more efficient and will meet the requirement in fuel economy providing a high pressure mechanism is used to perform the cycle. Calculations and tests show that it should be possible to commercialize a high pressure turbine of the type referred to having a fuel consumption of approximately 0.3 lb per hp-hr. Fig. 4 is an exterior view of such a turbine which has a fuel injection, opposed-piston, two-stroke Diesel engine between the compressor and turbine wheel instead of the burner chamber as in the low pressure turbine.





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QUALITY CASTINGS MADE TO DO THE JOB

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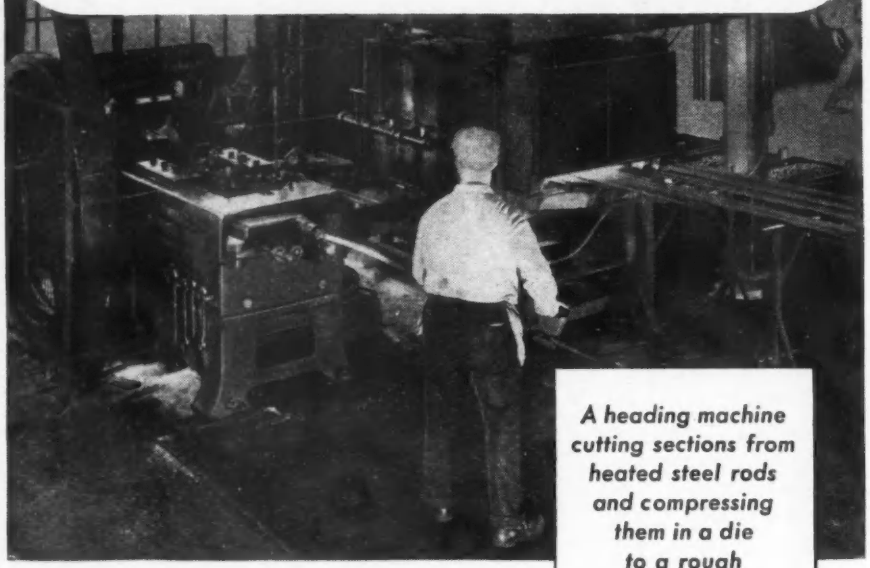


A heading machine cutting sections from heated steel rods and compressing them in a die to a rough spherical shape

The steel is carefully chosen and inspected, even before it gets to the heading machine. After being "born" here, balls are carefully "brought up," through a long series of grinding and lapping operations, to the unbelievably high standards of finish, sphericity and precision which have made Strom Metal Balls the standard of Industry. Strom Steel Ball Co., 1850 South 54th Avenue, Cicero 50, Illinois.

Strom BALLS Serve Industry

Largest Independent and Exclusive Metal Ball Manufacturer

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE *and* AVIATION INDUSTRIES

Continuing narrow fluctuations in general business activity are indicated. The *New York Times* index for the week ended Oct. 5 stands at 132.7, as against 133.8 for the preceding week and 116.7 a year ago.

Electric power production increased slightly in the week ended Oct. 12. The output was 14.3 per cent above the corresponding amount in 1945, as compared with a like advance of 11.2 per cent shown for the preceding week.

Railway freight loadings during the same period totaled 899,443 cars, 0.8 per cent less than the figure for the week before and 19.2 per cent above the corresponding number last year.

Crude oil production in the week ended Oct. 12 averaged 4,737,400 barrels daily, 834 barrels more than the preceding average and 956,750 barrels above the comparable output in 1945.

Production of bituminous coal and lignite during the week ended Oct. 5 is estimated at 12,120,000 net tons, 4.4 per cent below the output in the week before. The total production in 1946 so far reported is 10.2 per cent less than in 1945.

Civil engineering construction volume reported for the week ended Oct. 17, according to *Engineering News-Record*, is $108,205,000, or 32 per cent above the preceding weekly figure and 48 per cent above the comparable sum in 1945. The total recorded for forty-two weeks of this year is 163 per cent more than the corresponding amount in 1945. The increase in private construction is 281 per cent, and the rise in public construction is 78 per cent.

The wholesale price index of the Bureau of Labor Statistics for the week ended Oct. 12 is 126 per cent of the 1926 average, as compared with 125.1 for the preceding week and 105.3 a year ago.

Member bank reserve balances increased $123,000,000 during the week ended Oct. 16. Underlying changes thus reflected include an increase of $104,000,000 in Reserve bank credit and an increase of $41,000,000 in Treasury deposits with Federal Reserve banks, accompanied by a reduction of $11,000,000 in circulation.

Total loans and investments of reporting member banks increased $62,000,000 during the week ended Oct. 9. A rise of $217,000,000 in commercial, industrial and agricultural loans was recorded. The sum of these business loans, $9,381,000,000, shows a net increase of $3,110,000,000 in twelve months.

Just off the Press **NEW TEXT BOOK ON AUTOMOBILE BODY ENGINEERING AND DESIGN**

"Automobile Body Engineering and Surface Development," written by Gustave Chutorash, is based on the author's connection of fifty years in the industry.

During the period of October 23, 1946, to a sealed date in December 1946, the book will retail at the introductory price of $15.00 per copy. After that date it will retail at the established price of $20.00 a copy.

Send order and check to:

GUSTAVE CHUTORASH

308 Boulevard Bldg., 7310 Woodward Ave., Detroit 2, Mich.

1946 Motor Vehicle Factory Sales*

U. S. Plants

	Passenger Cars	Trucks	Buses	Total
January	56,367	44,994	467	101,828
February	57,782	34,914	265	92,961
March	85,810	37,636	527	123,973
April	130,816	80,762	948	212,526
May	168,759	75,373	789	244,921
June	141,090	60,038	774	201,902
July	209,180	87,454	862	297,496
August	247,261	97,881	1,067	346,209
September	232,280	95,642	833	328,755
Total—9 Mos.	1,329,345	614,694	6,532	1,950,571

*Automobile Manufacturers Association

Air Grinders BY ARO

✔ POWERFUL
✔ LIGHTWEIGHT
✔ STALLPROOF

ARO offers a complete range of Air Grinders for all types of work—from fine finish burring and polishing in tool rooms...to heavy duty production grinding. A 2" heavy duty grinder is shown above.

Switch to ARO Air Tools all along your production lines—for grinding, polishing, drilling, screw-driving, nut-setting, sanding, filing, and other jobs. Save time—cut costs—improve quality. Precision-built... dependable. Write for literature. The Aro Equipment Corporation, Bryan, Ohio.

NEED TOOLS NOW? SEE YOUR ARO JOBBER!

THE KNOWN precision gauge of laminations in the solidly bonded Laminum shim makes machining unnecessary in fitting machine parts. But consider this too . . . it assures accuracy by preventing errors (sometimes spoilage) due to inexperience. Want performance data?

Laminum shims are cut to your specifications. For maintenance, however, shim materials are sold through industrial distributors.

Laminated Shim Company, Incorporated
51 Union Street • Glenbrook, Conn.

LAMINUM
THE SOLID SHIM THAT peels FOR ADJUSTMENT

News of the Industry

(*Continued from page 47*)

that automotive products and basic materials may not be free of ceilings for some weeks or months yet. According to Washington sources, these items probably will be among the last to be lifted. However, there is some belief that it may come by the end of the year or shortly thereafter. One factor that might bring about a faster decontrol of automobile and truck prices would be a refusal of manufacturers to raise wages until a price increase for their product is assured. Instead of taking the blame for another round of price boosts on cars and trucks, the OPA might conceivably remove all restrictions, especially since it now is fighting a losing battle anyway.

Machine Tool Shipments and Orders Declined in September

Shipments of machine tools during September dropped off nearly $1.5 million from August, according to the National Machine Tool Builders Ass'n. New orders declined 12 per cent during the month and unfilled orders dropped slightly.

Power without Purpose

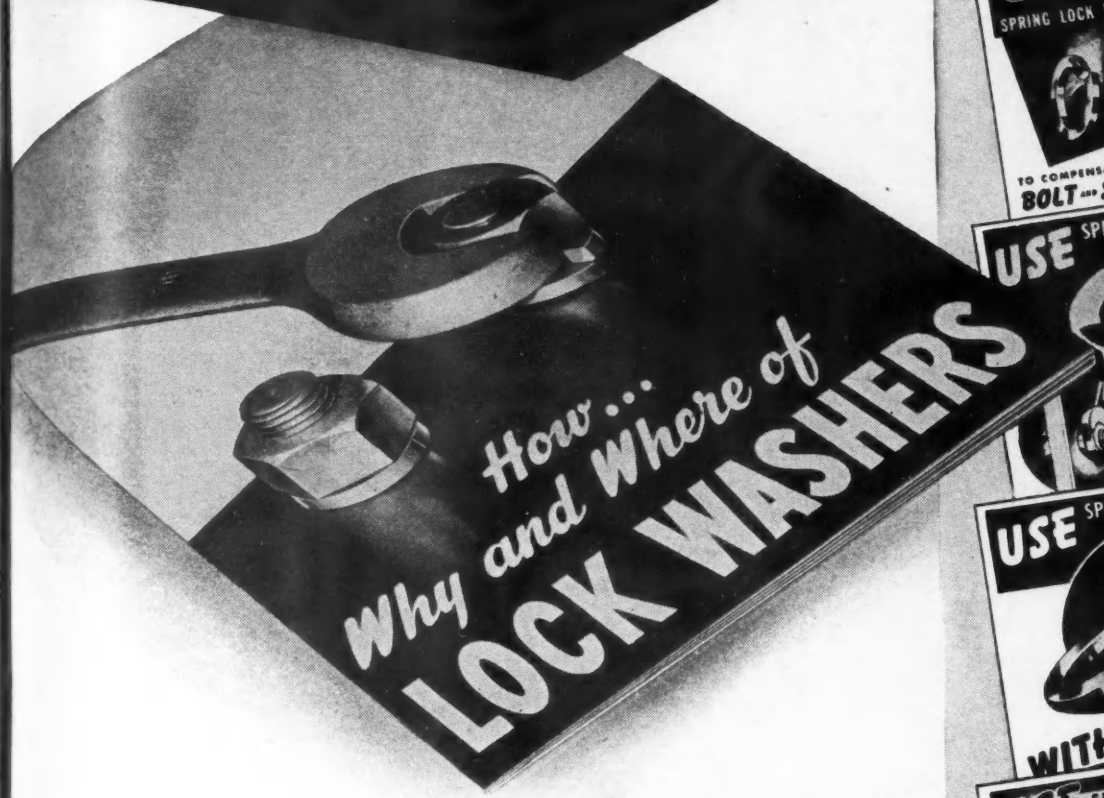
(*Continued from page 15*)

But if there be no single peace-time purpose then of what unharmful use can single-purpose, war-time power be in multi-purpose peace-time? We cannot any more say that "A" must sell to "B" at "X" price *in order to win the war;* nor can we say "D" must pay "E" a specified "Y" dollars an hour *in order to win the war.* Out of such orders emanating in peace-time from dictatorial government we should now leave out the very significant words, "in order to win the war." But what the government has done in some situations is to pretend that we are still fighting the war, and on that excuse has hung on to many of its war powers intact. This is an hypocrisy that anyone can penetrate, but when penetrated he is face to face with the question, "Well what then *is* the purpose?" It is a question he had better answer, and do something about, for if he lets it go by default then what he will face is the fact of unlimited power running amuck without good purpose to guide its employment.

The decision we must make, therefore, is whether we shall forthwith terminate authoritarian government in America, and so get on with the fulfillment of the millions of diversified competing wants of peace-time as free men, or whether we shall find new pretenses for perpetuating authoritarian government in America.—*From an address before the Rotary Club of Chicago.*

IF YOU BUY OR SPECIFY LOCK WASHERS

GET THIS BOOK!



Spring LOCK WASHER Specification
USE SPRING LOCK WASHERS
TO COMPENSATE FOR BOLT AND SCREW S-T-R-E-T-C-H-I-N-G
USE SPRING LOCK WASHERS
AS BEARINGS
USE SPRING LOCK WASHERS
WITH LOCK NUTS
USE SPRING LOCK WASHERS
TO DEFEAT RUST AND CORROSION
USE SPRING LOCK WASHERS
TO SAFEGUARD AGAINST VIBRATION

NEW FACTS . . . SPECIFICATIONS . . . RECOMMENDATIONS

You should know about Lock Washers

From the latest American Standards Specifications right on through to what to use and where. That's how complete this new Diamond G Lock Washer booklet is. On the right are shown some of the pages from this new book. In addition there are many other facts that every design engineer, production manager, purchasing agent and other executive should have at his finger tips when buying or specifying lock washers or other fastening devices.

This book is just part of the complete service the Diamond G man has to offer you. He is ready to help you with data and engineering advice . . . plus supplying you with a complete line of flat and lock washers—from No. 0 to 2" in all materials and finishes. For quick deliveries, high quality and product satisfaction write, wire or phone...

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WASHERS • • FLAT WASHERS • • STAMPINGS • • SPRINGS • • HOSE CLAMPS • • SNAP AND RETAINER RINGS

Only WARNER ELECTRIC BRAKES

Give you *all* these Time-and-Money-Saving Advantages

Engineered to meet the Specific Needs of Trailer Braking

SIMPLICITY— No other brakes equal Warner Electric Brakes for simplicity of design and construction. Full clearance under tractor and trailer. Nothing to get knocked off, leak, chatter or freeze. No exposed braking equipment . . . no rods to rattle . . . no tubes to split . . . no troublesome boosters and connections. Easy to install . . . no tapping of manifolds . . . no expensive motor work.

INSTANTANEOUS, POSITIVE ACTION— Positive-acting braking power is developed within the brake itself. Because the braking mechanism is *electrically controlled,* there is no time lag. Regardless of distances from cab to rear trailer wheels, any amount of stopping power is *instantly available.*

CONTROLLED BRAKING POWER — Driver can pre-set the "Vari-Load" dial on dash so it adjusts the electric brakes on the trailer to give correct braking to meet road and load conditions.

SYNCHRONIZED OPERATION WITH EITHER AIR OR HYDRAULIC SYSTEMS— Warner Controller synchronizes hydraulic or air brakes on tractor with Electric Brakes on trailer. Regular tractor foot pedal then operates both systems *together.*

ALL-PURPOSE CONNECTION — One rugged Electrical Cable Connection provides contacts for Brakes, Running and Parking Lights, Stop and Turn Signals—ALL electrical contacts. As easy to plug in as a radio.

UNMATCHED ECONOMY— Warner Electric Brakes are inexpensive to install due to their simplicity. Use only as much current as tail light. The most important economy factor is that they require minimum of servicing thus preventing costly delays and tie-ups of trailer equipment.

PROVED DEPENDABILITY — Warner Electric Brakes have been performance-proved by leading tractor-trailer fleet operators during many years of efficient, trouble-free service — also on thousands of military vehicles. It is noteworthy that 80% of all power-brake equipped trailing vehicles purchased by the government during World War II — had Warner equipment.

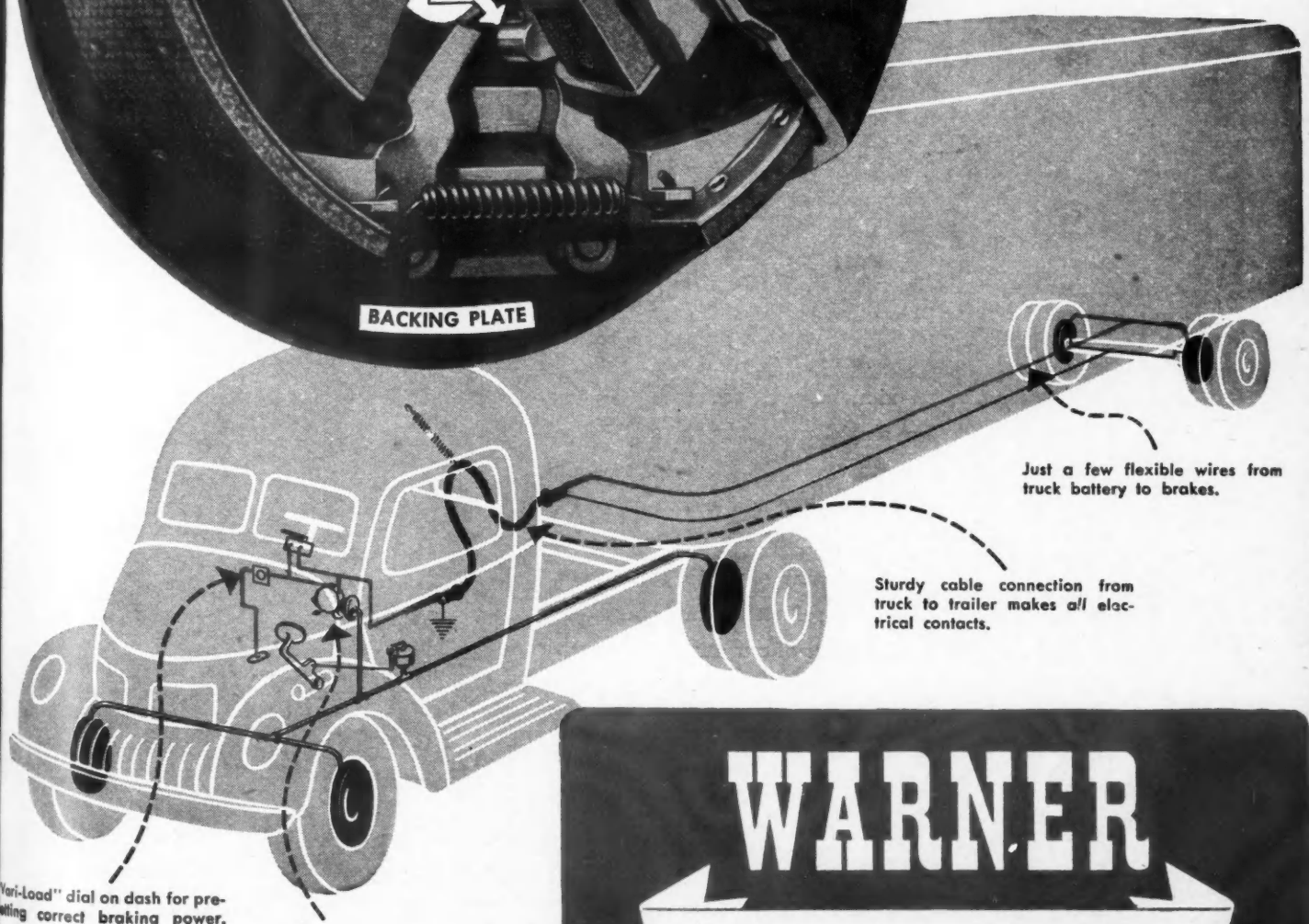
GREATER SAFETY— When both the tractor and trailer are equipped with Warner Electric Brakes their *instant* "stopping power" under *absolute control* assures greater safety. All brakes "come in" at the same time, but with various *amounts* of power. Therefore, rear trailer wheels get the effect of coming in first — and the tendency to skid or jack-knife is prevented, thus giving protection to driver and load — and avoiding costly repairs and tie-ups of equipment.

For best performance and customer satisfaction, standardize on Warner Electric Brakes for your trailers. Write for illustrated literature explaining all their advantages.

WARNER ELECTRIC BRAKE MFG. COMPANY
BELOIT, WISCONSIN

Specialists in the manufacture of Electric Trailer Brakes since 1927

The Warner Electric Brake is a simple mechanical brake, operated by an electro-magnet and armature disc. Each wheel is a complete brake unit. The braking power is generated within the brake itself. A wire to the battery and a controller complete the system — famous for its simplicity.



Just a few flexible wires from truck battery to brakes.

Sturdy cable connection from truck to trailer makes *all* electrical contacts.

"Vari-Load" dial on dash for presetting correct braking power.

Controller operates trailer's electric brakes *in unison* with truck's hydraulic or air brakes.

WARNER
ELECTRIC BRAKES

New Production Equipment

(*Continued from page* 46)

ends of part can be made at different relative heights.

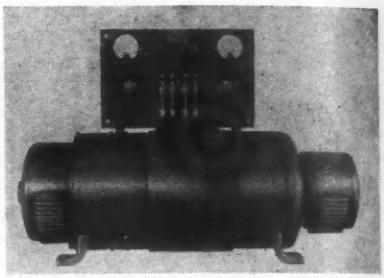
Spindle heads are of independent motor-driven type. Either one or 1½ hp motors can be used. Heads are available in two speed ranges of 25 to 1200 rpm or 50 to 2400 rpm. Speed changes are by pick-off gears and each set of two gears provide four possible speed changes.

The machine has an eight in. by 41½ in. long table. The maximum table feed stroke is 12 in. and rate of table feed is infinitely adjustable between ½ in. and 38 in. per minute. Rapid traverse rate is 325 in. per minute. Both feed and rapid traverse movements of the table are controlled hydraulically by a Sundstrand hydraulic feed unit mounted in the machine base. The length of feed and rapid traverse strokes are controlled by dogs mounted to the machine table.

MOTOR GENERATOR CORP., Troy, Ohio, is introducing a new line of low-voltage electroplating generators. The line includes six models ranging in size from 100 amp at six volts to 2000 amp at six volts or 1000 amp at 12 volts.

Illustrated is the No. 130 Model which is rated 1000 amp at six volts or 500 amp at 12 volts. The generator is driven by a 10-hp motor at 1200 rpm. The standard tank size normally used with this model is six ft by 30 in. by 30 in., or a tank containing about 250 gal of solution. For chromium plating, individual 100-amp, 60-volt generators are used right at the tank.

With this double commutator machine, the commutators can be connected in series to get 12 volts or less



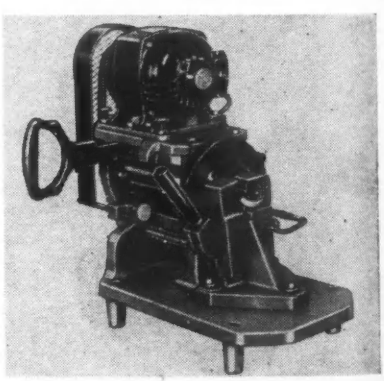
Model 130 electroplating generator

for barrel plating, electrocleaning, etc. Because of the large size, this machine is compound wound and equipped with interpoles or commutating poles which insure sparkless commutation, taking the place of diverter poles which are used in the smaller sets. Special metallic brushes carry the high current with minimum loss.

A NEW spray-type machine for continuous pickling and washing of

(*Turn to page* 76, *please*)

Electric Tube Cutting and Flaring Machine



This electric tube cutting and flaring machine is being offered to the trade by the C. J. Unger Manufacturing Co., Dayton 10, Ohio. Designed to cut, flare and trim copper or aluminum tubing in one operation, this machine has a capacity of more than five thousand flares in eight hours of operation. As the tubing does not revolve, any length of tubing can be handled. Removable jaws for various sizes of tubing are available.

CLEAN as a whistle!

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. . . And rarin' to go . . . Your castings and metal parts are ready for finishing after a single run through a Blakeslee Metal Parts washer. Cuts cost, saves labor, production time and cleansing compound . . . Fifty years of experience and 5,000 installations enable us to solve your cleaning problems efficiently and economically. Take advantage of our engineering service.

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STANDARD AND SPECIALS Engineered for you

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NEW YORK, N. Y. TORONTO, ONT.

NEW GREYHOUND
"Silver-sides"

Steered by ROSS

Ross

Distinctive in appearance and distinguished in performance, the new Greyhound "Silver-sides" has, among its many advantages, the *good steering* supplied by Ross.

"Silver-sides" is one of the Greyhound fleet of new motor coaches, all Ross-equipped. Whatever the steering job . . . light or heavy . . . Ross gives the utmost in performance and satisfaction.

Cam & Lever Steering

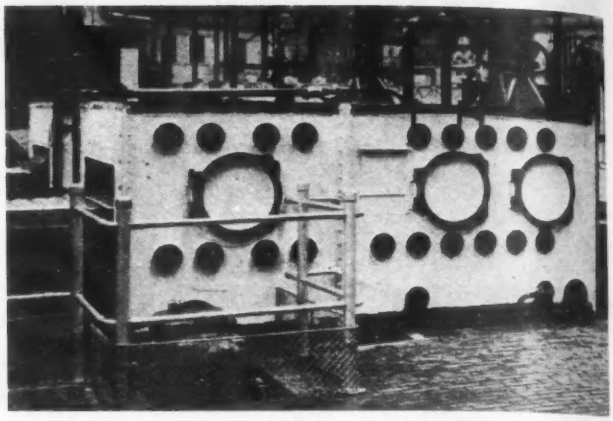
ROSS GEAR AND TOOL COMPANY, LAFAYETTE, INDIANA

any metal part requiring surface preparation for the application of enamel or other coatings or for the removal of scale is announced by the Industrial Products Sales Division of the B. F. Goodrich Co., Akron, Ohio.

Pieces are fed onto a conveyor at the entrance to the machine and carried through the spraying and washing cycles, emerging acid free and ready for the succeeding operations.

Each unit is designed individually to suit the particular manufacturing problem and is lined with rubber by the company's Vulcalock process of adhering rubber to metal.

Straight line operation is obtained, with materials being fed into the conveyor feeding into the machine and automatically carried through each pickling and washing operation without intermediate handling.

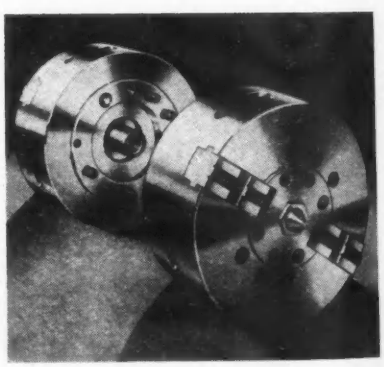


Goodrich pickling and washing machine

Production can be standardized, no special equipment being required for handling pieces of different shapes and sizes. The conveyor carries any size or shape within the over-all size limits of the unit. No special racks are required for handling.

A TWO-JAW compensating power chuck, Series 23100-A, designed to drive work on centers where exceptionally heavy cuts are being taken with carbide-tipped tools at high spindle speeds, is announced by the Skinner Chuck Co., 344 Church St., New Britain, Conn.

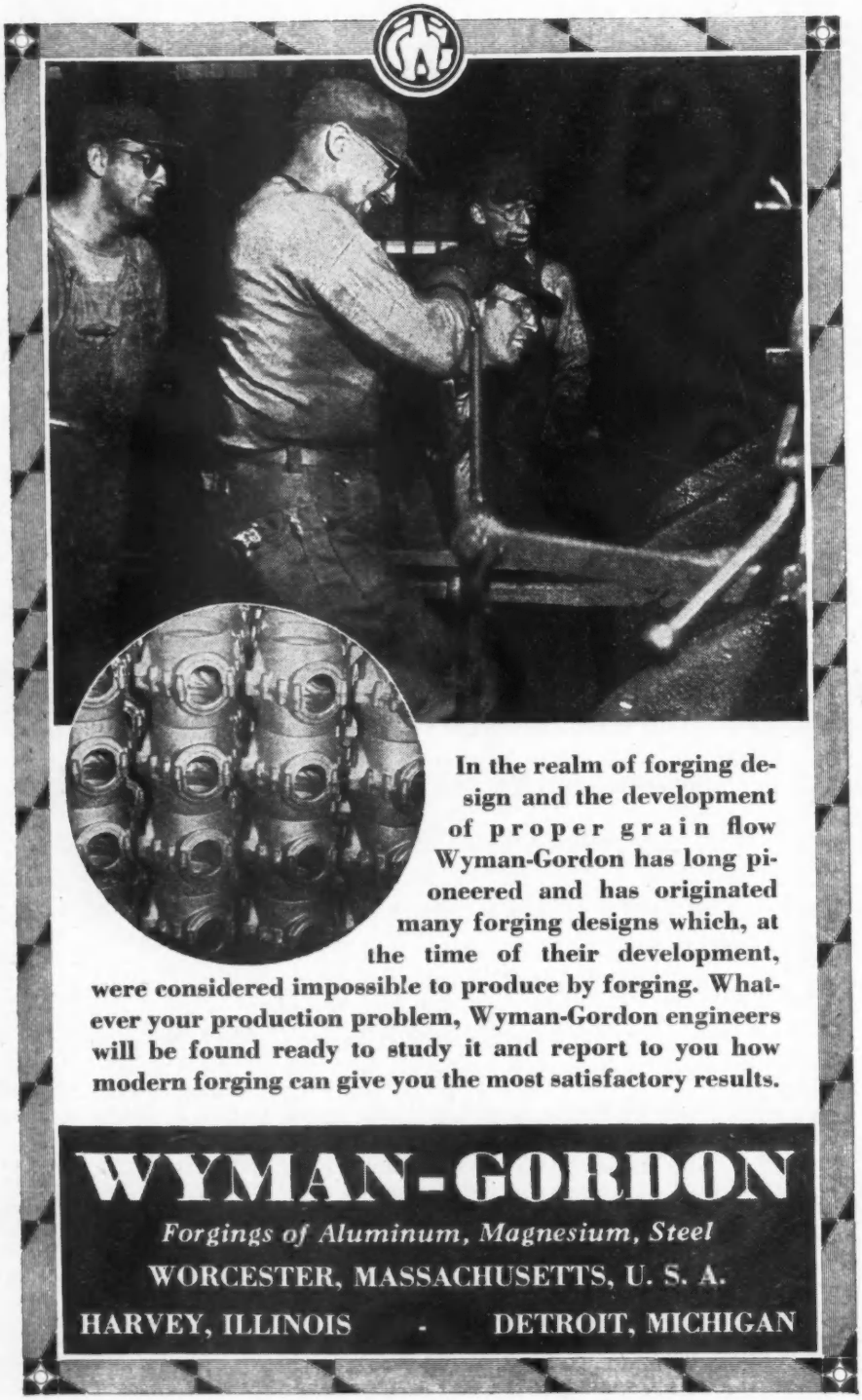
Compensating action of the jaws, sufficient for gripping rough-forged or cast surfaces, is provided by a rocker attached to a plunger. The center is of high-speed steel and fits into a standard Morse taper hole in the center plate. A thin nut, threaded on the maximum diameter of the taper, permits removal of the center without removing the center plate.



Skinner two-jaw power chuck

The center plate is made of hardened alloy steel and is attached to the chuck body by six screws. The center plate recess, the outside diameter of the center plate, the center, the center seat, and all other critical surfaces are held

(*Turn to page 78, please*)



In the realm of forging design and the development of proper grain flow Wyman-Gordon has long pioneered and has originated many forging designs which, at the time of their development, were considered impossible to produce by forging. Whatever your production problem, Wyman-Gordon engineers will be found ready to study it and report to you how modern forging can give you the most satisfactory results.

WYMAN-GORDON

Forgings of Aluminum, Magnesium, Steel

WORCESTER, MASSACHUSETTS, U. S. A.

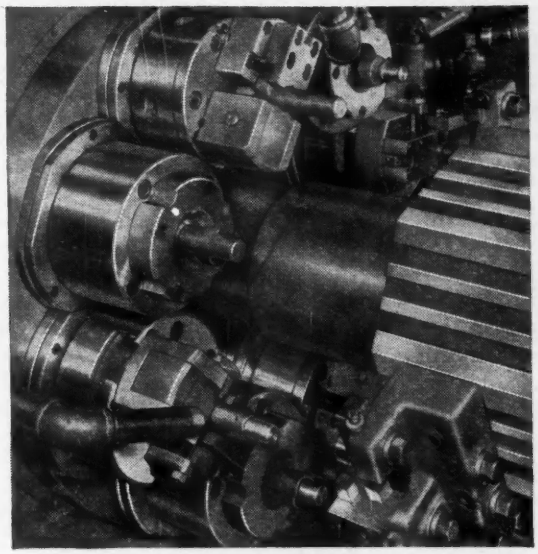
HARVEY, ILLINOIS - DETROIT, MICHIGAN

LEADERSHIP BASED ON ACCOMPLISHED FACTS

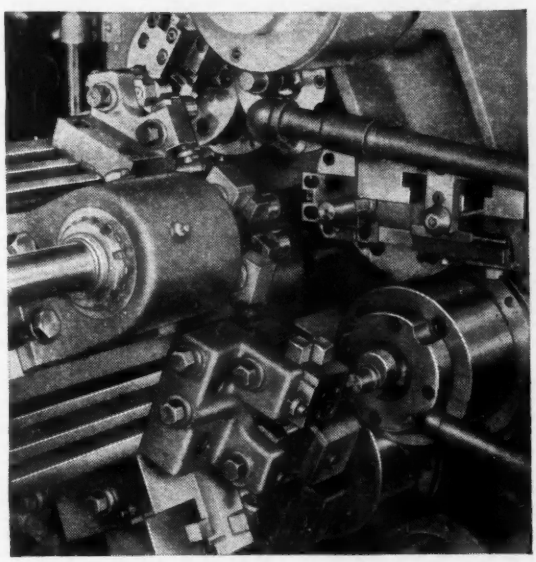
The piece shown above is a good illustration of the versatility of the New Britain Model 86 Eight Spindle Automatic Chucking Machine. By using double index on the Model 86, four spindles are used for one end of the crank shaft and the other four spindles used for the other end. Thus each time the machine indexes, it delivers a finished part.

Very important, too, is the maintenance of close diameter limits of both ends and holding the limits between the shoulders of the eccentric. This calls for a remarkable degree of precision in locating the shaft during the second operation . . . a severe test of the accuracy of the spindles and the carrier locating and locking mechanism.

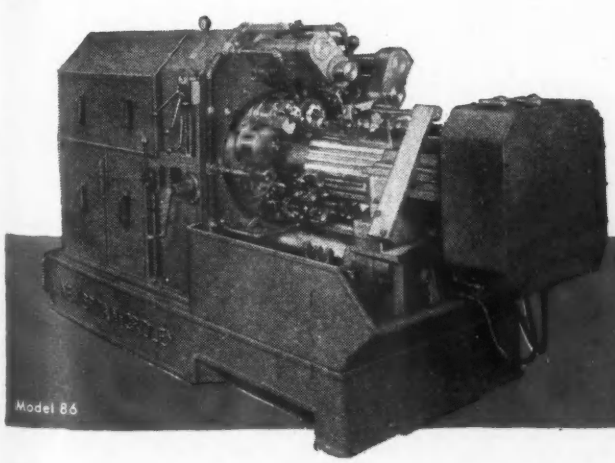
Production figures prove the ability of the machine to meet these testing requirements: The fifteen necessary operations are performed in 19 seconds. The gross production is 190 pieces per hour, with accuracy maintained well within the specified tolerances. Your work may or may not be similar to this particular job. One thing is sure . . . if it involves high production, and you want low cost per piece, the New Britain representative in your locality is the man to see.



FRONT VIEW—Entirely open end construction provides accessibility for simplified chucking, cutting tool and attachment setup.



REAR VIEW—Wide open end construction provides extra large chip...space accessibility from three sides and from above that permits excellent visibility and easy tool adjustment.



NEW BRITAIN AUTOMATICS

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN, CONNECTICUT
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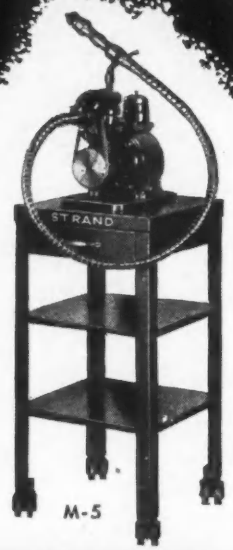
M-01043

Engineering Library

when you want Speed-

when you want power-



. . . in your job of grinding, polishing, buffing, sanding, drilling, reaming, screw-driving or nut-setting, you want a Strand Flexible Shaft machine, because a Strand will do it faster, better, and stand up to it longer.

Strand Flexible Shaft machines provide constant speeds with greater operator convenience. Hundreds of attachments easily interchanged—125 types and sizes—models include vertical and horizontal type machines from 1/8 to 3 h.p. Distributors in all principal cities.

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Every Type
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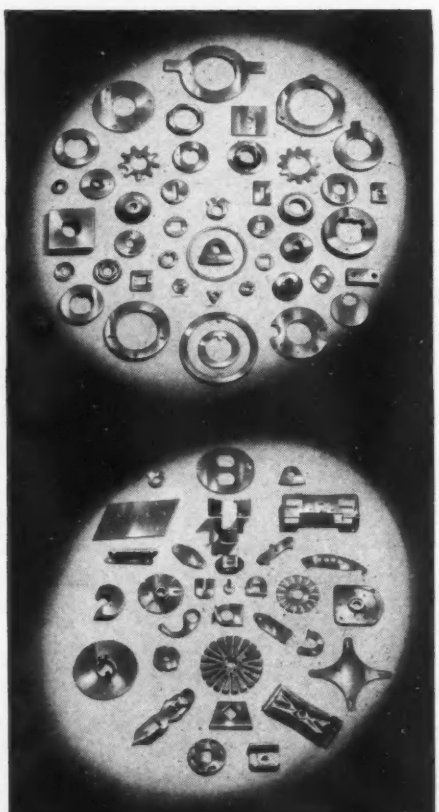

WROUGHT WASHER MFG. CO.

THE WORLD'S LARGEST PRODUCER OF WASHERS

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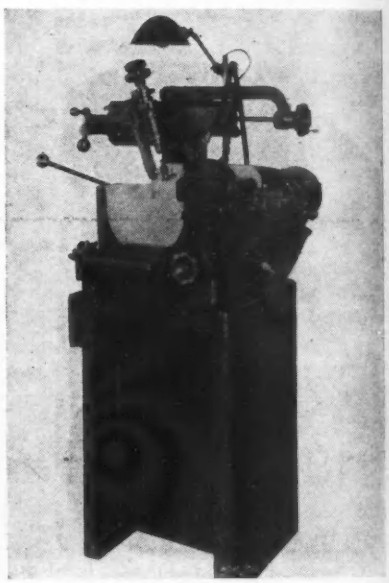
to very fine tolerances to insure a highly accurate center.

The two "floating" jaws are of the non-adjustable type. The top surfaces of the solid master actuating jaws are machined with a tongue and groove to American Standard dimensions.

This new chuck is now available in 8-in. diameter size for a Type A6 and 12-in. size for a Type A8 spindle. It will soon be available in 10-in. diameter for a Type A6 spindle and 15-in. for a Type A11 spindle.

A SPIRAL POINT tap sharpener, called the Blake flute grinder, is offered by the Edward Blake Co., 634 Commonwealth Ave., Newton Centre 59, Mass. The new machine provides the positive, mechanical controls necessary for the accurate and speedy sharpening of both the spiral points and the straight flutes —not only of taps but also of other straight- and angular-fluted tools, such as countersinks, drills, etc.

The machine is completely self-contained, the grinder proper being mounted on a steel fabricated base



Blake flute grinder

which houses, in a rear compartment, a removable coolant system unit.

The tap shank is held in a special radius-grip draw-in collet which grips with merely sufficient force to keep the tap from slipping in the collet. The end of the tap is supported by means of back-rest bushings.

Locating of the tap for grinding the first flute is accomplished by swinging into position a self-retracting locator arm containing a pawl pin which is inserted into the nearest flute. Completion of the swing of the locator arm turns the tap to the proper grinding position. The collet is then tightened and the first flute ground. The remaining flutes are positioned by an index plate and indexing lever mechanism.

(*Turn to page 82, please*)

Switch to

AUTO-LITE

BATTERIES

built by the organization that makes complete electrical systems for many of America's finest cars, trucks and tractors

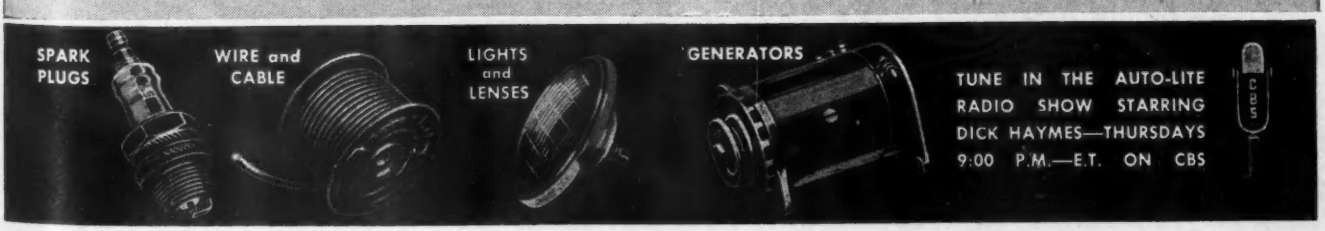
MONEY CANNOT BUY A BETTER BATTERY

For more than 35 years, the name Auto-Lite has meant automotive ignition and electrical parts of the highest quality. Standard equipment for many of America's finest cars, trucks and tractors, Auto-Lite batteries, spark plugs, instruments and gauges, warning signals, lights and complete automotive electrical systems have established a world-wide reputation for dependability in service.

Auto-Lite engineering and precision manufacturing insures the fact money cannot buy better, more dependable equipment. A new booklet listing many of the major products of The Electric Auto-Lite Company is just off the press. To obtain your copy, write to

THE ELECTRIC AUTO-LITE COMPANY

Sarnia, Ontario **Toledo 1, Ohio**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In Braking... A NEW DAY!

DOUBLE DISC

Another Advancement in Disc Brakes for Farm Tractors

Not simply another brake! It's really Revolutionary! That's why, size for size, this new Lambert DOUBLE DISC Brake gives you MORE than any other Tractor Brake. You get MORE in Braking Power (due to more brake lining area) . . . in "stop-ability" with the same efficiency, going forward or back . . . in holding loads on steep grades . . . in longer lining-life . . . in speedy, easy adjustment . . . in greater operating economy! With all these *added* advatanges, this new DOUBLE DISC Brake has fewer parts . . . is smaller in size . . . lighter in weight. For the complete story of this "new day" in Tractor Brakes, write for new, filing size Data Folder.

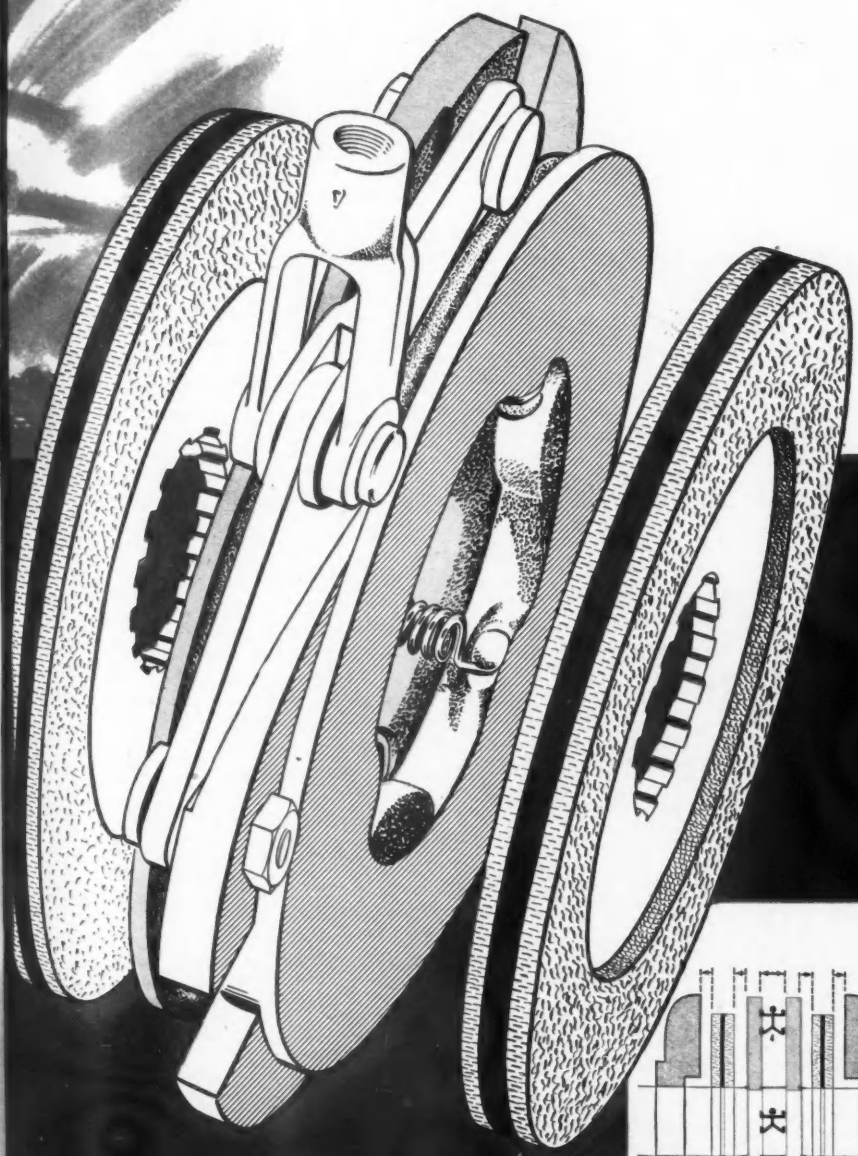
— for *automotive vehicles and industrial machinery*

Lambert Disc Brakes

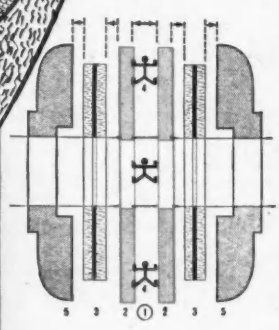
Air • Hydraulic • Mechanical

Products of a Division of the Auto Specialties Mfg. Co.

St. Joseph, Michigan • Windsor, Ont., Canada



How It Works



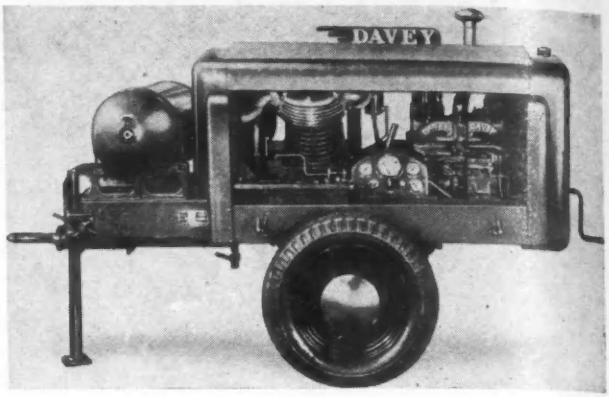
(1) Power applied by the yoke attached to each actuating disc by means of links, moves ACTUATING DISCS (2) in opposite directions from each other. As the ROTATING FRICTION DISCS (3) are engaged by ACTUATING DISCS, the turning movement on the discs brings the ENERGIZING ELEMENTS (4) into further play, thereby widening further the distance between the actuating discs (2) which in turn increases the pressure of the actuating discs against the rotating friction discs (3) as these engage the stationary SECONDARY PLATES (5).

- ✔More Brake Lining Area
- ✔Two Discs *(Four effective braking surfaces)*
- ✔Designed for Farm Tractors
- ✔Equally Effective Braking, in Forward or Backward Motion
- ✔Light Pedal Pressure
- ✔Fewer Parts, Easier to Assemble, All Interchangeable

1972

The collets are held in a workhead spindle which turns to provide the required indexing. The complete workhead operates on a vertical slide and is counterbalanced by a weight. The workhead can be swivelled to whatever angle desired, for grinding either straight flutes or angles.

THE DAVEY COMPRESSOR CO., N. Water and Saginaw Sts., Kent, Ohio, has just brought out a new Model 60V portable compressor. This unit is available in standard skid and two-wheel pneumatic tired trailer mounting styles, also with flanged wheels for railroad work.



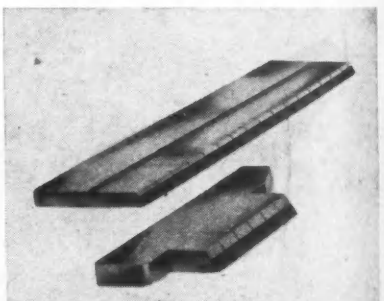
Davey Model 60V compressor

It is likewise offered complete with a Davey heavy-duty power take-off as an "Auto-Air" compressor for truck mounting. The compressor produces 60 cfm at 100 lb pressure and is designed for heavy duty service.

The compressor has one low-pressure cylinder with 5¾ in. bore and 4½ in. stroke. The high-pressure cylinder has 3⅝ in. bore. Operating speed is 1225 rpm.

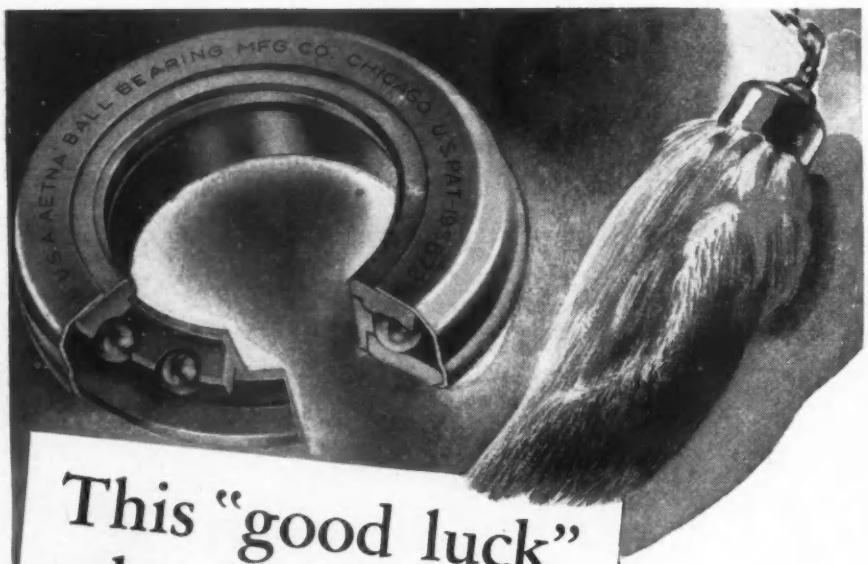
Weight of the two-wheel model is 2100 lb. Over-all dimensions are: length, 88 in.; width, 62 in., and height, 51½ in. The compressor in skid, trailer and railway models, is powered by a Hercules IXB engine.

SCULLY-JONES AND CO., 1901 S. Rockwell St., Chicago, Ill., have created a carbide-tipped work rest blade for centerless grinders of an entirely new design. The blade is segmented as shown, and damage to one or more of the segments does not require the blade to be scrapped, as it may be returned to the factory and the damaged segments replaced. This design is said to make it possible to use a harder, longer-wearing grade of carbide, which gives longer runs between grindings.



Scully-Jones work rest blade

The segment slots are self-clearing, being so designed that metal chips and grit are quickly carried away by the circulation of the coolant, preventing chips reaching and damaging the work being ground.



This "good luck" token gets results

—Aetna

It's one thing to "wish" good luck for a product. It's quite another to make dead-sure of its successful long life—by building into it the excellence typified by Aetna Bearings.

Advantages of the Aetna "T" Type Clutch Release Bearing are practical and to the point—

- **permanent true alignment of raceways—no eccentric thrust, no chatter, no excessive wear**
- **an oil-impregnated bronze retainer provides smooth, silent, enduring bronze-to-steel contact**
- **prelubricated for life**

These are the potent reasons why a majority of leading vehicle manufacturers, year after year, look upon the Aetna "T" Type Clutch Release Bearing as a trusted stand-by for a crucial "key position."

A simple, sensible step toward good luck and a long life for your product is to consult with Aetna engineers. Aetna Ball & Roller Bearing Co., 4600 Schubert Ave., Chicago 39, Illinois.

In Detroit: **Sam T. Keller**
7310 Woodward Avenue Phone: Madison 8840-1-2

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Aetna BALL & ROLLER BEARINGS

Buy Extra Savings Bonds Now

Future Automobile Engines

(*Continued from page* 38)

be ahead of the front wheels. For rear engine drive this engine fits in well due to its compactness.

Fig. 1, then offers:

(a) High degree of compactness.

(b) Maximum valve size.

(c) Maximum useful compression ratio.

(d) Maximum combustion roughness control.

(e) High degree of anti-detonation.

If all depends on the details of design of the individual controlling elements, such an engine can be good or bad, depending on the proportion of its components. It incorporates three basic considerations, high breathing, light metals and a short engine.

We recommend the F-head as a means of obtaining high breathing. However, there are other means of obtaining this quality. There are several designs of positively operated valves which give considerable breathing capacity and many other virtues. There are two basic problems where the valves are concerned today, one is breathing at high compression ratio, and the other is the temperature of the exhaust valve.

We are approaching the compression ratio limit with L-heads because the throat between bore and valves is the limiting factor. However, either through improved fuel or aluminum we shall be able to use 8 to 1 compression ratio, but this will be of little value at full throttle if intake is restricted, except that fuel consumption will improve through the part throttle range. This latter is extremely important by itself and sometimes justifies high compression even if performance does not go up. With the overhead valve we can improve the breathing materially because the intake valve is in the bore. However, so is the exhaust valve unless the diagonal position such as used in the Chevrolet is adopted. The diameter of the valves are limited, regardless. The temperature of the exhaust valve when in the head runs hotter than when it is in the cylinder block and to date the difference can be seen in the increase of valve seat width with use as compared to the L-head.

To control detonation it has been proven that we must fire from the exhaust valve, or hot area, toward the cold area or the clearance side which is usually toward the far side of the piston. We would prefer to have no exhaust valve. Engines without exhaust valves, in every case, have provided from 3 to 4 compression ratio higher usefulness. But we seek a simple, relatively low cost means of approaching these advantages. We want larger valves than can be installed either diagonally or side by side. We want to fire from hot to cold, and we want the lowest temperature exhaust valve head we can obtain, and we want a means of maximum heat absorption at the area of last gas to burn, all to minimize detonation.

The F-head does spell out these opportunities, if we really take advantage of conditions. In Fig. 2 we see sections through the valves of a small F-head and the full section through the exhaust and intake. This shows a general shape that will give good combustion control, large intake valve located at the entrance of burning gas into the clearance space, and providing no restriction around the intake valve opening for at least 180 deg with ample opening for the rest. A small exhaust valve to minimize the heat absorbed by it and the heat given off by it. It is not swept by the incoming gas which tends to expand the air as it comes in. It will receive gas cooling from the subsequent turbulence. The spark plug is over the exhaust valve in no uncertain manner and leaves room for development of spark plug design.

This type of engine is not new. It has in general form been used many times before, and is today in the show case of Rolls Royce in their Bentley of

(*Turn to next page, please*)

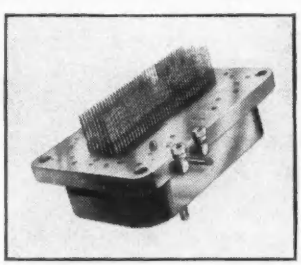
12,000 Holes per Hour! With New Gearless Multiple Spindle Drillhead!

The Zagar Gearless Drillhead can accommodate up to 400 drills in one head—drill up to 400 holes at one time! This revolutionary unit runs noiselessly and vibration-free on needle, tapered roller and precision ball bearings, and is lubricated by a patented automatic oiling system to insure trouble-free operation.

With this unit all holes are drilled at one pass, and valuable time is saved by the elimination of indexing and extra handling. It may be used on standard drill presses, or furnished as a complete hydraulic machine by the factory.

Another time saver, as well as a help on a tedious job, is chewing gum. The simple act of chewing seems to make the work go faster, easier—helping to relieve worker's fatigue—so that a better piece of work can be turned out with greater safety. Wrigley's Spearmint Gum may be used even when both hands are busy—right where the work is being produced.

You can get complete information from
Zagar Tool, Inc.
23881 Lakeland Blvd., Cleveland 17, Ohio



Zagar 220 Spindle Gearless Drillhead

AA-98

This Is MARION, INDIANA
Another 100% Layne City

—Marion, a busy, progressive and forward looking city of east central Indiana gets its entire water supply from Layne Well Water Systems. And taking a tip from the city are a brewery, a food processing plant, a radio and television station, two meat packers, a military home, a wire and rubber manufacturer, a glass company, a laundry and a wire and cable company—all of whom have their own individual Layne Water System plants.

—Seldom does an industrial product enjoy such dominating preference as is accorded to Layne Well Water Systems by Marion City and Factory executives. Such preference was earned through recognized reputation of superior quality and basically sound operation economy.

—Layne Well Water Systems are known to be the best that specialized engineering research can produce—and the best that American dollars can buy. For late catalogs and illustrated literature address Layne & Bowler, Inc., General Offices, Memphis 8, Tenn.

HIGHEST EFFICIENCY

Layne Vertical Turbine pumps are available in sizes to produce from 40 to 16,000 gallons of water per minute. High efficiency saves hundreds of dollars on power cost per year.

AFFILIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. ★ Layne-Atlantic Co., Norfolk, Va. ★ Layne-Central Co., Memphis, Tenn. ★ Layne-Central Co., Mishawaka, Ind. ★ Layne-Louisiana Co., Lake Charles, La. ★ Louisiana Well Co., Monroe, La. ★ Layne-New York Co., New York City ★ Layne-Northwest Co., Milwaukee, Wis. ★ Layne-Ohio Co., Columbus, Ohio ★ Layne-Pacific, Inc., Seattle, Wash. ★ Layne-Texas Co., Houston, Texas ★ Layne-Western Co., Kansas City, Mo. ★ Layne-Western Co. of Minnesota, Minneapolis, Minn. ★ International Water Supply Ltd., London, Ontario, Canada ★ Layne-Hispano Americana, S. A., Mexico, D. F.

LAYNE

WELL WATER SYSTEMS
VERTICAL TURBINE PUMPS

this year. This author held many discussions with Robotham of Rolls Royce back in 1937 and although he disagreed with many of the engine practices with which we were associated, he always agreed that the F-head lent itself to modern engine design. Today they generate 135 to 140 bmep with 6.5 to 1 compression ratio. At 7.5 to 1 they could attain 150 bmep and use a smaller engine.

(End of Part I. Part II will appear in an early issue.)

Aluminum Bearings For Caterpillar Engines

(Continued from page 29)

scratches in the aluminum bearings were caused by dirt particles carried by the oil.

Aluminum is almost totally unaffected by the corrosive constituents of some types of lubricating oils. The bearings in Fig. 1 show only a light surface etch due to corrosive action, which is the usual extent of corrosion found in any aluminum alloy bearings. Usually, no indication of corrosion is observed for several hundred hours and at no time does corrosive action impair the bearing quality.

An interesting observation of the behavior of aluminum bearing materials is that on the occasions when such bearings seized on the journal during over-load tests, the journal was not damaged beyond picking up a film of the bearing material. This may be easily removed with a mild abrasive or by a mild caustic solution without altering the original dimension or surface condition of the journal.

Since tests have shown that aluminum bearing material grows slightly during the first few hundred hours of engine service and since the coefficient of thermal expansion of aluminum is much greater than that of steel, aluminum bearings are fitted with slightly greater initial clearance than is customary with other types.

Laboratory investigation, which is now in progress, is pointing to new standards of bearing application, taking advantage of the superior properties of aluminum alloys. Investigation is being made of the correct $\frac{W}{D}$ ratios, clearances, fits, grooves, point of oil admission, oil pressure requirements, permissible oil temperature, load capacity, and other design standards. It was realized early in the investigation that new standards would be required to obtain the full benefit of some of the superior qualities. Meanwhile, substitutions of aluminum in current engine models, with only a few alterations required by the different coefficient of expansion, make available the long life which was originally desired.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933

Of AUTOMOTIVE and Aviation INDUSTRIES, published semi-monthly at Philadelphia 39, Pa., for October 1, 1946.

State of Pennsylvania } ss.
County of Philadelphia }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared G. C. Buzby, who, having been duly sworn according to law, deposes and says that he is the Business Manager of the AUTOMOTIVE and Aviation INDUSTRIES and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Chilton Company, Chestnut and 56th Sts., Philadelphia 39, Pa.; Editor, Julian Chase, 5601 Chestnut Street, Philadelphia 39, Pa.; Managing Editor, None; Business Manager, G. C. Buzby, East Sunset Ave., Chestnut Hill, Philadelphia 18, Pa.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) Chilton Company, Chestnut and 56th Sts., Philadelphia 39, Pa.

Holders of more than 1% of the capital stock outstanding of Chilton Company: Estate of C. A. Musselman, 260 Sycamore Ave., Merion Station, Pa.—Beneficiaries: Mabel M. Musselman, Mary M. Acton, David Acton; Charlotte M. Terhune, 160 E. 48th St., New York, N. Y.; C. S. Baur, c/o Chilton Co., 100 E. 42nd St., New York 17, N. Y.; J. H. Van Deventer, 50 Lake Shore Drive, Veils Grove, Peach Lake, Brewster, N. Y.; Mrs. Beulah Fahrendorf, 19 Tunstall Rd., Scarsdale, N. Y.; Mary M. Acton, 260 Sycamore Ave., Merion Station, Pa.; Mabel M. Musselman, 260 Sycamore Ave., Merion Station, Pa.; Dorothy S. Johnson, 1115 Fifth Ave., New York, N. Y.; Ann E. Tomlinson, c/o Bankers Trust Company, P. O. Box 701 Church Street Annex, New York, N. Y.; Ethel G. Breen, Trustee u-w of Charles W. Anderson, Old Greenwich, Conn.—Beneficiaries: Robert C. Anderson, Percival E. Anderson, Charles W. Anderson, Jr., Annie L. Clark; John Blair Moffett, 1608 Walnut Street, Philadelphia, Pa.—Agent for J. Howard Pew, J. N. Pew, Jr., Mabel P. Myrin, Mary Ethel Pew; Elizabeth J. Bailey and Ellwood B. Chapman, Trustees Estate of James Artman, Deceased, 930 Real Estate Trust Building, Phila., Pa.—Beneficiaries: Franklin Artman, Vera Watters, Alvin C. Artman, Elizabeth J. Artman, Marion A. Pratt, George H. Pratt, by assignment, Edwin Moll, by assignment; Frederick S. Sly, 149-40 35th Ave., Flushing, L. I., N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders, and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is . (This information is required from daily, tri-weekly, semi-weekly and weekly publications.)

G. C. BUZBY, *Pres. & Bus. Mgr.*

Sworn to and subscribed before me this 27th day of September, 1946.

PHILIP J. SHIRE, JR.

(My commission expires at the end of the next Session of the Senate.)
[SEAL.]

HERE'S *Comfort*...

THAT PUTS A PLUS FACTOR INTO *DIGGING POWER*

★ MILSCO Bucket Type . . . a patented, Ventilation-Drain slot is a feature adaptable to all MILSCO bucket-type cushion seats. Quick drainage means longer life, ventilation means more operator comfort.

Milsco MILWAUKEE

THE HUSKY, POWERFUL *LORAIN-820* IS MILSCO CUSHION SEAT EQUIPPED!

MILSCO Engineers know that the operator of mobile equipment who is cushioned against "Seat Fag" does a better job. They are specialists with long experience in solving seat problems on all types of heavy-duty mobile equipment.

The 2-yd. LORAIN-820 Power Shovel, a product of The Thew Shovel Co. of Lorain, Ohio, provides a typical example of MILSCO "know-how" in action. Here is a rugged, powerful piece of equipment well known for heavy-duty performance. Because the LORAIN-820 operates under the toughest of excavating conditions, severe shocks and impacts are inevitable. This presented a seating problem calling for the utmost protection to the operator against shocks and impacts and the fatigue they induce. A further problem was presented by limited cab space. *Both of these problems were met by MILSCO Cushion Seat No. 711.*

Whatever your equipment, whether a lightweight unit or a heavy hitting Power Shovel, MILSCO can solve your seat problem economically. Write today for the specialized information MILSCO can give on quality made seats to meet your cost requirement.

MILSCO MANUFACTURING COMPANY
2758-D NORTH 33RD STREET • MILWAUKEE 10, WISCONSIN

STANDARDIZED TYPES

MILSCO Crusader Type . . . a seat with stout steel side arms, a backrest to relax the operator, soft padding over coil springs that achieves a high degree of safety with comfort.

MILSCO Commander Type . . . a seat with a soft cushion over coil springs and a flexible backrest that synchronizes the movement of the operator with the motion of the machine.

MILSCO Utility Type . . . a seat with a strong steel frame, a soft cushion and a stout backrest made for maximum comfort where the going is hard.

MILSCO Bucket Type with backrest . . . all MILSCO bucket type seats (with Ventilation-Drain feature) can be equipped with a padded backrest.

MILSCO Semi-Bucket Type . . . a "pony" size seat especially suited for equipment where cab space is limited (cranes, power shovels).

Disc and Cup

VORTOX FIRSTS

To meet the pressing demand of engine and equipment manufacturers for the installation of Oil Bath Cleaners in smaller and smaller spaces—Vortox met this challenge with another "Vortox First"—The Cup Disc, invented in 1928,

By—

1. Creating a quiescent zone in the oil cup to insure more effective settling of the dirt.
2. Governing the amount of oil passing into the filter.
3. Controlling the circulation of fresh oil which carries entrained dust into the cup.

The Cup Disc permitted the design and installation of smaller Vortox Cleaners which still maintained the high efficiency and large dust holding characteristics of the earlier and larger cleaners. Write for complete information on latest Vortox Designs.

VORTOX AIR CLEANERS

VORTOX COMPANY

Claremont, California

SPECIAL STUDS

Shift Your Problem TO OUR SHOULDERS

We have the plant capacity and the know-how to turn out the special studs which exactly fit your specifications . . . are completely equipped to manufacture special machine screws, nuts and bolts or special headed and threaded parts. We specialize in specials.

Try us on threading only, or completed parts threaded or unthreaded. Single and multiple spindle. Screw machine products up to 3¼ inches from steel, brass or other metals. Threaded rods 10 feet to 12 feet in length.

Send us your specifications and let us quote.

KRAMER & KRAMER

3629 Medford, Los Angeles 33, California

Be 100% With 10% Buy Bonds

Results of the War in the Netherlands

(Continued from page 43)

urgent replacement. In order to bring the average car life of the different makes up to the level of prewar units, the whole existing car stock will have to be replaced with new cars at short notice, and for that replacement and renewal only import can be considered, because the Dutch industry consists solely of the Ford factory at Amsterdam. For the time being, the Ford factory at Amsterdam will receive spare parts for Fords and Mercury types from Detroit. The British Ford factories provide Amsterdam with two new light models, namely the Anglia and Prefect. These models are sent to Amsterdam on consignment. Ford Amsterdam will be allowed to build the Fordson tractor, the Ford V-8, and the Thames under license. The important share in imports that was claimed by the Opel and DKW factories now becomes vacant for makes of another nationality. As to how far and to what extent the German factories will be supplying Holland cannot yet be foretold. It is however known, that the Mercedes Benz, Heuschel, Vomag, Hanomag, Klockner, Deutz, and MAN are delivering trucks on a restricted scale.

As regards the import into Holland of American products, the following amounts have been computed. Total import for 1946 from the United States was valued at $376,000,000. Of this amount $250,000,000 is destined for the industrial sector, while of this $100,000,000 has been set aside for the metals group (including machines). The total import from the United States amounted in 1939 to $90,000,000, of which $9,000,000 was for passenger cars, 10 per cent therefore of the total.

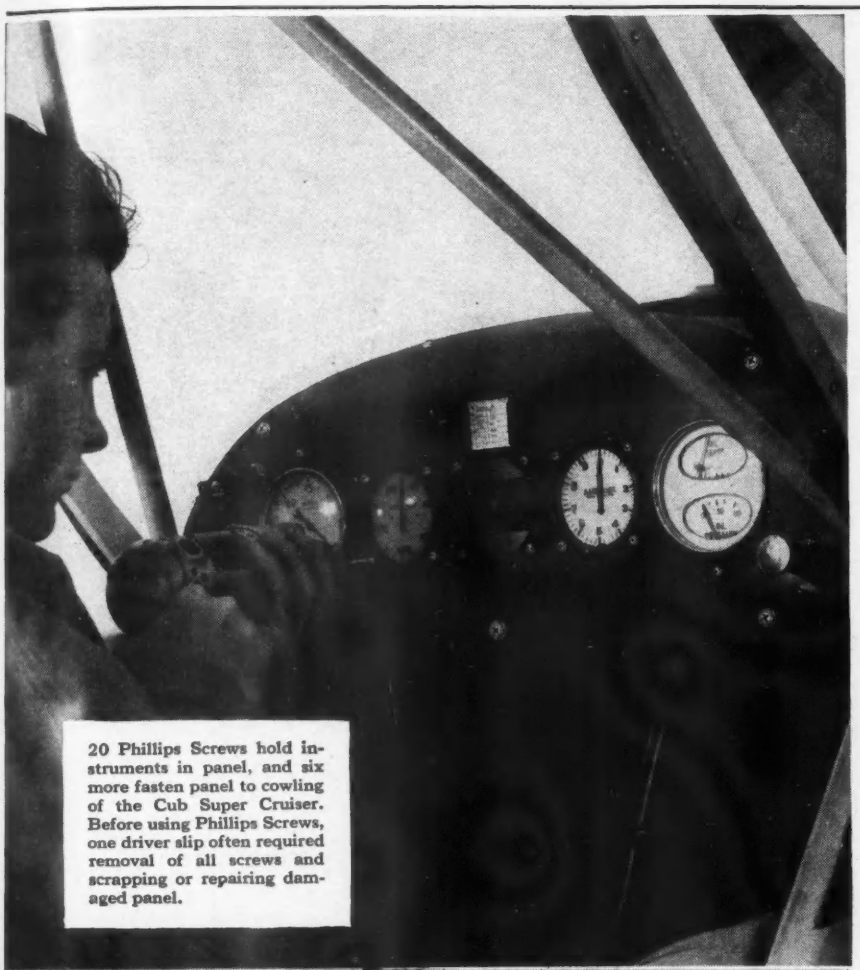
We must, however, draw attention to the already advanced state of the experiments by the Dutch Philips factory in the field of hot air engines. The Dutch motor car user is greatly interested in this development.

As to the field of advertising, the war has brought about radical changes. Of the daily papers appearing before the war, some have now dropped off. On the other hand, however, since the end of hostilities a number of papers originally springing from the underground press of the occupation, must be added, and of these, quite a few appear to be healthy and have come to stay. The precarious position of paper stocks has resulted in most dailies only having very restricted space for advertisements. A large part of the available publicity space is taken up by announcements for personnel wanted, family notices and official government information, so that the attention of the readers is much more attracted to this space than before the war. Of course only small advertisements are placed. A size of 8 by 12

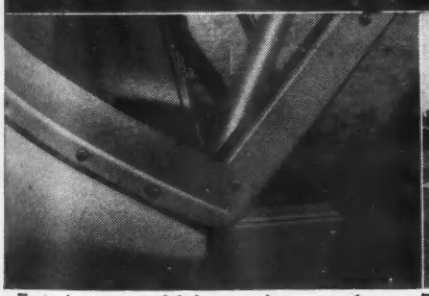
(Turn to page 93, please)

"DRIVE TWICE AS FAST"

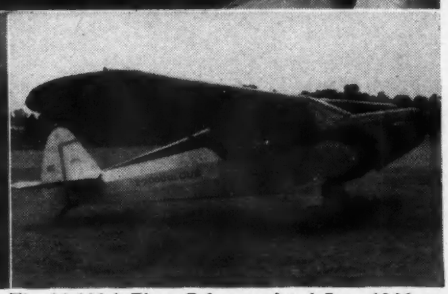
—Phillips Screws help Piper build 1100 Cubs a month!



20 Phillips Screws hold instruments in panel, and six more fasten panel to cowling of the Cub Super Cruiser. Before using Phillips Screws, one driver slip often required removal of all screws and scrapping or repairing damaged panel.



Fastenings near fabric covering—no place for driver slips—no slips with Phillips Screws.



The 20,000th Piper Cub, completed June 1946. Phillips Screws speeded this big production!

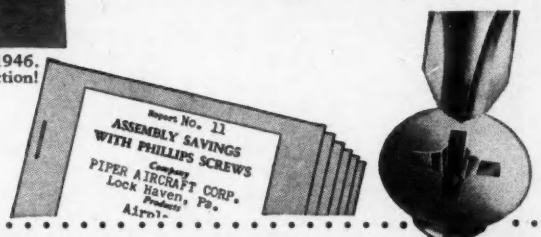
"We started using Phillips Screws back in 1938, when . . . and because . . . we were getting set for large scale production," declared Piper's Assistant Chief Inspector to the James O. Peck Co. investigator, studying assembly savings with Phillips Screws in well-known plants. "Today we're shipping our 20,000th Piper Cub. That proves how much faster Phillips Screws are to drive.

"IDEALLY SUITED TO POWER DRIVING, which we needed for high production. Unlike slotted screws, Phillips Screws hold the driver bit in place without a guide or other support, automatically center themselves in the screw holes and catch the thread quicker. Phillips Screws are easily twice as fast to drive.

"TAKES LESS TIME TO MAKE SKILLED ASSEMBLERS. It takes a man much less time to become familiar with and do a good job of driving Phillips Screws. Since the Cub is fabric covered, any driver slips would cost us expensive, undesirable patching, doping and repainting . . . up to $1.00 a slip. Same thing on the instrument panel where a single driver slip would cost up to $3.50. If we were using slotted screws, assemblers would have to go much slower, especially at the learning stage, to avoid such damage.

"WE GET A BETTER INSPECTION. Don't have to watch out for burred heads as we used to do with slotted screws. Fabric tears and instrument panel scratches are out. And the Phillips Recessed Head certainly makes a more attractive, workmanlike job wherever screw heads are exposed."

GOOD IDEAS FOR YOUR ASSEMBLY LINE in this independently made report of Piper's assembly savings with Phillips Screws. Similar studies . . . covering metal, wood and plastic products . . . available to you without cost or obligation. Use the coupon TODAY!



PHILLIPS *Recessed Head* SCREWS

Wood Screws • Machine Screws • Self-tapping Screws • Stove Bolts

26 SOURCES

American Screw Co.
Atlantic Screw Works
Atlas Bolt & Screw Co.
Central Screw Co.
Chandler Products Corp.
Continental Screw Co.
Corbin Screw Div. of American Hdwe. Corp.
The H. M. Harper Co.
International Screw Co.
Lamson & Sessions Co.
Milford Rivet and Machine Co.
National Lock Co.
National Screw & Mfg. Co.
New England Screw Co.
Parker-Kalon Corporation
Pawtucket Screw Co.
Pheoll Manufacturing Co.
Reading Screw Co.
Russell Burdsall & Ward Bolt & Nut Co.
Scovill Manufacturing Co.
Shakeproof Inc.
The Southington Hardware Mfg. Co.
The Steel Company of Canada, Ltd.
Sterling Bolt Co.
Stronghold Screw Products, Inc.
Wolverine Bolt Company

AA-11

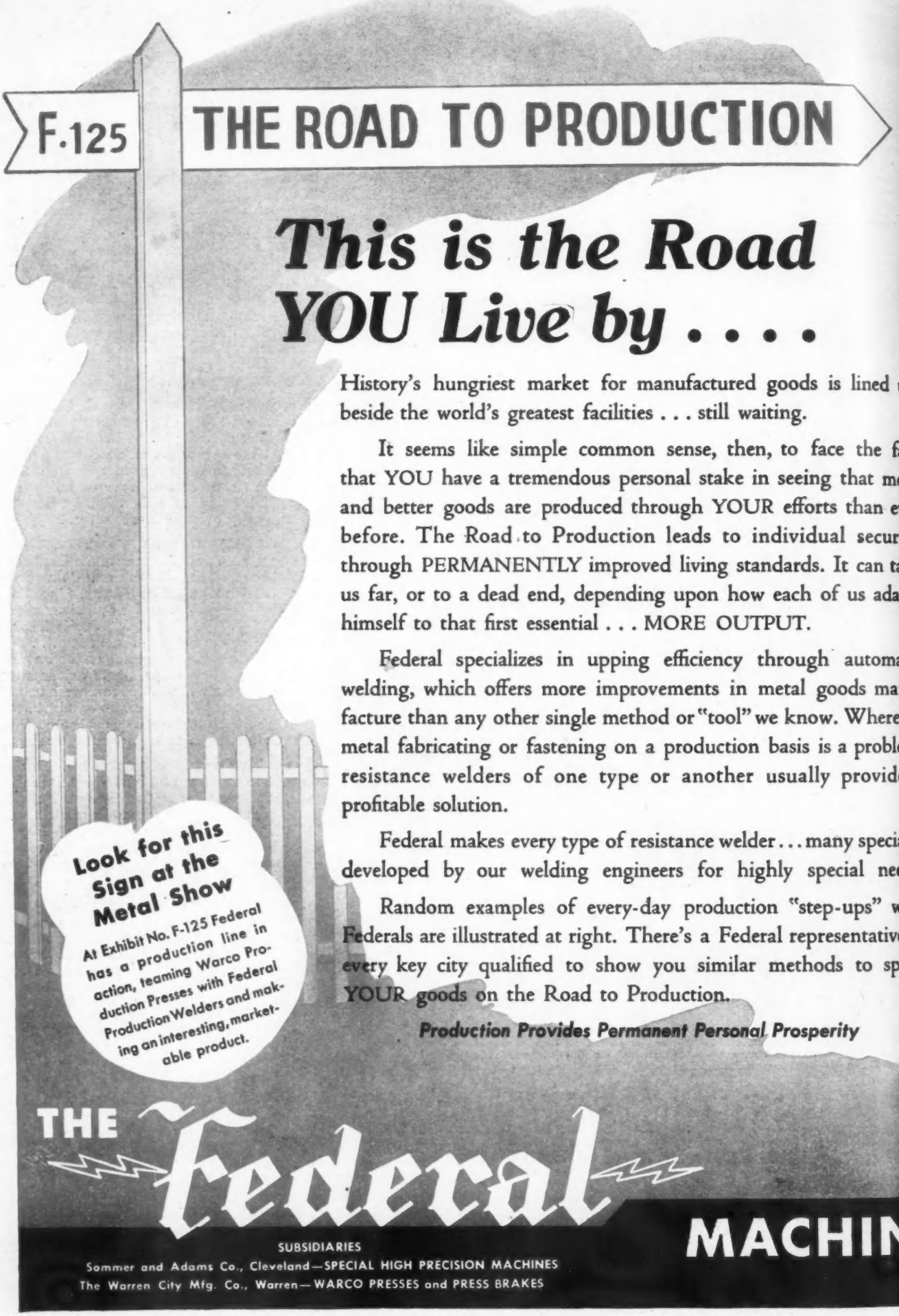
Phillips Screw Mfrs., c/o Horton-Noyes
2300 Industrial Trust Bldg., Providence, R. I.

Send me reports on Assembly Savings with Phillips Screws.

Name.....

Company.....

Address.....



This is the Road YOU Live by . . . .

History's hungriest market for manufactured goods is lined up beside the world's greatest facilities . . . still waiting.

It seems like simple common sense, then, to face the fact that YOU have a tremendous personal stake in seeing that more and better goods are produced through YOUR efforts than ever before. The Road to Production leads to individual security through PERMANENTLY improved living standards. It can take us far, or to a dead end, depending upon how each of us adapts himself to that first essential . . . MORE OUTPUT.

Federal specializes in upping efficiency through automatic welding, which offers more improvements in metal goods manufacture than any other single method or "tool" we know. Wherever metal fabricating or fastening on a production basis is a problem, resistance welders of one type or another usually provide a profitable solution.

Federal makes every type of resistance welder . . . many specially developed by our welding engineers for highly special needs.

Random examples of every-day production "step-ups" with Federals are illustrated at right. There's a Federal representative in every key city qualified to show you similar methods to speed YOUR goods on the Road to Production.

Production Provides Permanent Personal Prosperity

Look for this Sign at the Metal Show

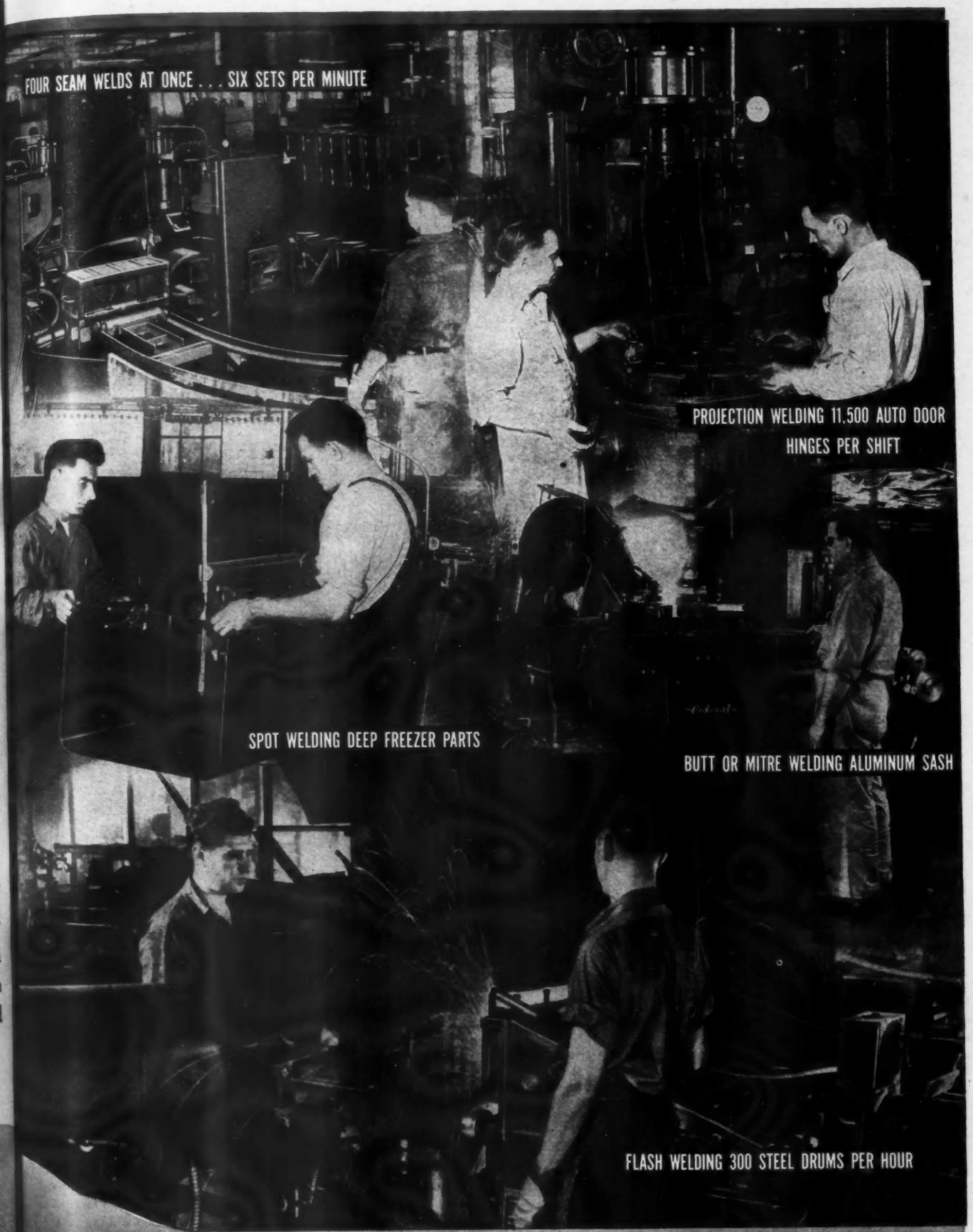
At Exhibit No. F-125 Federal has a production line in action, teaming Warco Production Presses with Federal Production Welders and making an interesting, marketable product.

THE Federal MACHINE

SUBSIDIARIES

Sommer and Adams Co., Cleveland—SPECIAL HIGH PRECISION MACHINES

The Warren City Mfg. Co., Warren—WARCO PRESSES and PRESS BRAKES


FOUR SEAM WELDS AT ONCE . . . SIX SETS PER MINUTE
PROJECTION WELDING 11,500 AUTO DOOR HINGES PER SHIFT
SPOT WELDING DEEP FREEZER PARTS
BUTT OR MITRE WELDING ALUMINUM SASH
FLASH WELDING 300 STEEL DRUMS PER HOUR

NE AND WELDER COMPANY

MEMBER RESISTANCE WELDER MANUFACTURERS ASSOCIATION • RWMA

220 DANA STREET • WARREN, OHIO

Speeding NEW CAR *Production*

The widespread use of Landis Threading Equipment throughout the automotive industry—where threads must be held to closest tolerances—is just another proof that thread production throughout all metal industries can be safely and economically handled by Landis Threading Machines and Die Heads.

The Landmaco Threading Machine threading truck steering knuckles. Threads must be exactly right to assure the permanent holding of a vital part in a truck steering mechanism.

Write for Bulletin H-75

LANDIS MACHINE COMPANY

WAYNESBORO · PENNA · U·S·A·

cm has been the maximum permitted up to the present.

The advertisement tariff increases which have taken place, are in this manner more than compensated for. Generally speaking, the newspapers do not accept more than one advertisement per week for insertion. The illustrated periodicals are having trouble with quality of paper, owing to which they cannot give their printed matter the same typographical finish as before the war. They place their advertisements fairly regularly, and a few accept a larger size than 8 by 12 cm. The trade journals get only a small portion of the available paper stocks allotted to them. The advertising space at their disposal is, as a result of this, accordingly small. Of these newspapers or periodicals a few accept larger advertisements; other trade journals insert smaller sizes though generally speaking, as maximum size, the 8 by 12 cm is fixed. All papers are being read with great assiduity, and as we have already remarked, present-day advertisements enjoy the same degree of prominence and effect as those larger announcements of prewar days.

Publicity by radio in Holland itself is not possible; Radio Luxemburg may take care of wireless publicity for Western Europe in the near future again.

Cinema publicity is usual in the Netherlands. However, the making of publicity films is not yet possible. The showing of films is of course more expensive than in 1940. Although advertising by means of posters and direct mail is again permitted, only a restricted amount is available due to paper scarcity.

It is apparent, therefore, that to be able to reach in an effective manner the able-to-purchase part of the general public, advertising must be considered by far the most important, if not the only great means of publicity. In comparison with the time before 1940, it is true the prices are high, but this is compensated for, as we have already said, by the fact that the public bestows decisively much more attention to the advertisement pages than hitherto.

Jeep Station Wagon Clutch

We have received from The Atwood Clutch Co. and are pleased to publish the following correction regarding details of the Atwood clutch fitted to the jeep station wagon which was described in the October 1 issue of AUTOMOTIVE AND AVIATION INDUSTRIES. The last paragraph in the first column on page 38 should read as follows:

"An 8½ in. OD Atwood clutch No. 8501-23 is used. This clutch is provided with springs which give a pressure plate pressure of 1020 lb or a torque capacity of 143 ft-lb. Used in conjunction with this clutch unit is a driven plate supplied by Borg & Beck."

NEW "TAP" SCREW
is actually a cutting tool that removes material to TAP its own threads!
ELIMINATE
TAPPING COSTS
Here's how it's done. The slot, corresponding to flutes of a tap, provides two balanced cutting edges and a chip reservoir.
In photo note chips cut and pushed ahead.
HOLTITE "TAP" SCREWS
U.S. Patent No. 2,292,195
Other patents pending.
Do not confuse this remarkable new screw with the ordinary self-tapping screws that forcibly displace the material by a cold forging action.
Fundamentally a narrow fluted two-flute tap, this new "TAP" screw actually removes the material when cutting its own perfect mating threads to effect tighter, stronger fastenings that resist vibration.
Fine or curled metal chips, and tough, gummy non-metallic cuttings free themselves readily in the open slot reservoir to prevent binding. The two balanced cutting edges of slot cut threads much deeper than their own diameter.
Eliminate tapping operations by using HOLTITE "TAP" screws in metal, castings, alloy, rubber, plastics, etc. You'll get stronger fastenings at less cost!
CONTINENTAL
SCREW CO.
New Bedford, Mass., U.S.A.

Synthetic Rubber Grows to a 700 Million Dollar Industry

Full scope of America's victory in its wartime battle for an independent supply of crude rubber was disclosed with the release of data on 1945 rubber consumption by The Rubber Manufacturers Association, which emphasizes the staggering output of the nation's 700 million dollar synthetic rubber plant.

The factual tabulation of consumption in all classes of crude and reclaimed rubber covered the years 1941 through 1945, the fifth year of the synthetic rubber program. These figures show how military necessity had driven up consumption of vital synthetic rubbers from a scant 6000 tons in 1941 to a record-breaking 798,798 tons last year.

The United States consumed 781,259 tons of rubber in 1941, of which synthetic pilot plants contributed less than one per cent of the total tonnage. Production was still actually on a pilot plant basis when the Japanese swept down through the Malayan peninsula and into the Netherlands Indies, cutting off more than 90 per cent of the world's natural rubber supply. The fall of Singapore in early 1942 was the starter's shot that catapulted the nation, its armed forces and three of its major industries — rubber, oil, and chemistry — into a desperate race for new sources of rubber, even for survival. Success of the government-industry team in attaining mass production of high grade synthetic rubbers before the precious stockpile of natural rubber had melted away is reflected in the table on rubber consumption through the war years.

Heavy Duty TAPERED PIPE TAPPING Easy With BUHR TAPPING HEADS!

When production problems arise—consult Buhr for the solution . . . Specialists in multiple spindle drilling, reaming and tapping equipment for over 25 years. We have helped many manufacturers speed production for greater profits.

Individual Lead Nut Type Spindles

4-spindle head is driven directly from an electric motor with change gears to provide correct spindle speeds.

Spindles are of the individual lead nut type providing a quick change of lead screws and nuts to adapt to use of 1¼, 1½, 2, 2½ and 3" collapsible tapered pipe taps.

Taper tap feed and collapsing mechanism is enclosed at rear of head under motor mounting bracket.

All gears are shaved and induction hardened

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